Electrical World

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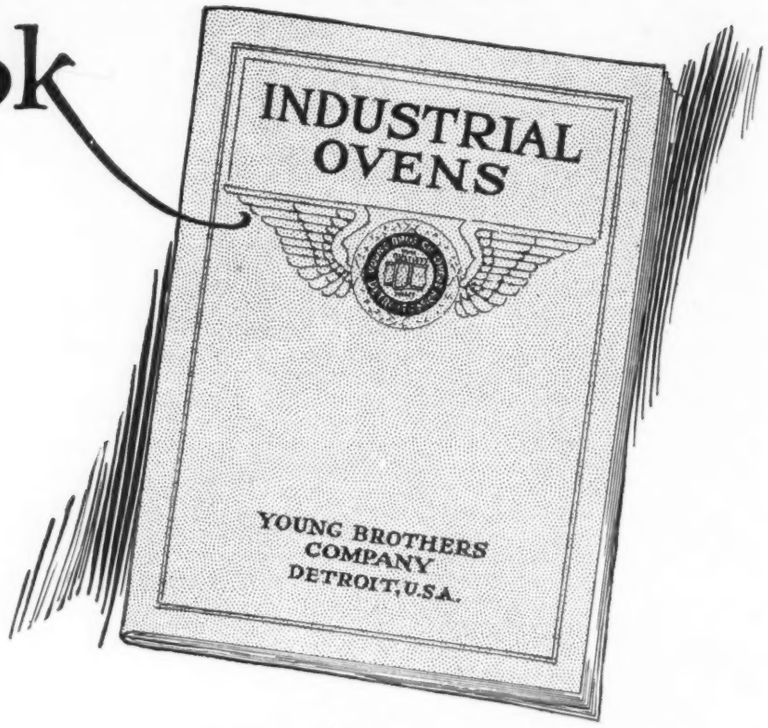

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Electrical World

New York, Saturday, July 16, 1921

The New World Needs Something New in Personal Attitude

TIMES have changed of late in the electrical business. A very big change has taken place about us. As big a change must come within us.

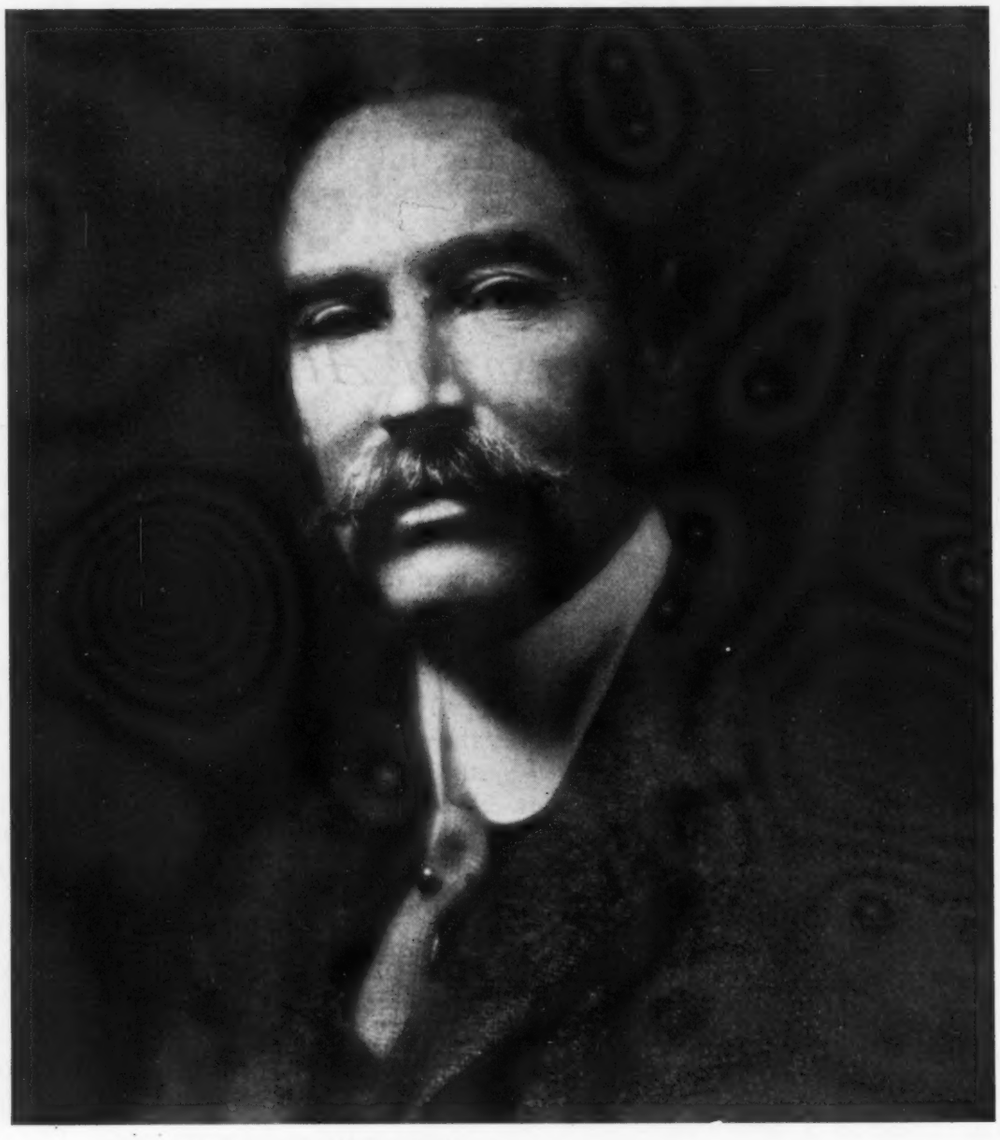
During the war-born period we had a hungry market—more demand for goods than goods to fill demand. Sellers were very "choosy," and buyers took what they could when they could get it. Moreover, central-station companies were oversold in power to war-stimulated industries. They were not looking for more business. They were dodging it. Every kind of a salesman became more and more of an order taker and less of a developer of business. Many central-station companies practically disbanded their sales departments. Then the pendulum swung.

The result is a new combination of conditions, demanding a new attitude and different treatment. Orders must be sought. Opportunities must be developed. Customers must be won and held by service. Business must be built up again before times can be normal, and business men must do the building. There is no use in waiting for the world to settle down. It is each man himself who must restore his business by his own good work and thinking. And, in the main, just as he meets this test will he come into more prosperity.

As to the central station—read the figures. The total maximum load in 1920 was 12,870,000 kw. It is estimated that on January 1, 1922, this load will have increased to 13,500,000 kw. With the added installations that the year will bring, the total generator capacity at that time will take care of a total load of 14,100,000 kw., or 600,000 kw. more than the expected burden. That power plus the large idle capacity that idle factories have made available — less adequate reserve—must now be sold. And Samuel Insull says, *"Get busy with your business-getting departments."*

So there is plenty of material to sell, plenty of appliances, plenty of power, and there is plenty of need for sales. It is a different world we have today to work in. Business has simply turned around in its mental attitude because conditions have reversed. The problem for the individual is how to conform, how to line up his habits both of thinking and of working, how to pull with the times and not against them, how to recognize the actual situation as it is and progressively adapt himself to it.

Surely the first thing is really to *know* the times as they unfold. Therefore, watch and understand the changes as they come. Study the broader trend of our industry's affairs by reading more broadly and more thoughtfully in the ELECTRICAL WORLD.



Henry Hobart Porter

An engineer and executive of broad experience and high professional and business standing who has an exceptional record of achievement in planning and directing the activities of many important organizations

TO KEEP a public service company strong and healthy is no sinecure, but much greater is the task of one who takes weak, ill-managed and generally run-down properties and makes of them profitable and well-managed servants of the public. Although an engineer by education and profession H. Hobart Porter is essentially an executive and organizer. Such a combination of attributes has enabled him to take public utilities in a state of disorganization and disintegration often regarded by the financial world as almost hopeless and, by hard work and quick thinking and through efficient reorganization, put life and vigor into them and place them on a sound operating basis. The engineer in the man has observed the mechanical and physical deficiencies and prescribed the remedies. The intuition of the natural executive has seen the weaknesses in the corporate structure and known almost instinctively the proper reorganization measure to apply. From such work the public utility industry has benefited not only by the immediate lesson of each case but also because every important utility that has been kept off the rocks of financial disaster has helped to strengthen public confidence in this industry.

A notable example of Mr. Porter's achievements in this direction was the reorganization of the American Water Works & Guarantee Company of Pittsburgh, now the American Water Works & Electric Company of New York. He is at present engaged in a similar work as vice-president and general manager of the Brooklyn (N. Y.) City Railroad.

Mr. Porter was born in New York City, March 12, 1865, and was graduated in 1886 from the School of Mines of Columbia University. The following year he spent at Columbia as a fellow in geology. He then engaged in mining in Mexico and later in Arizona, where he operated some mining properties controlled by the late George Westinghouse, who in 1891 brought him to East Pittsburgh to work for the Westinghouse Electric & Manufacturing Company. Later he went to New York for this organization, becoming assistant to the vice-president and general manager. In 1906 he resigned to form with E. N. Sanderson what is now the well-known engineering firm of Sanderson & Porter, which at the start devoted its energies largely to engineering and construction work, later branched out as manager and owner of public utilities and is now active in the operation of approximately a hundred public service companies. He is now taking a prominent part in the proposed reorganization of the transit systems of Greater New York.

Mr. Porter has always taken an active interest in engineering association work. He is a member of the four large national engineering societies, of the Engineering Foundation and of the executive committee of the engineering division of the National Research Council.

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Death of Prof. Francis B. Crocker

IN THE DEATH of Prof. Francis Bacon Crocker the industry loses a pioneer who contributed greatly to its upbuilding professionally as well as commercially. Long before many of the present electrical manufacturing companies were known, Crocker with C. G. Curtis formed the C. & C. Electric Company, and in 1888, with Schuyler Skaats Wheeler, he founded the Crocker-Wheeler Company. In those days, also, electrical engineering as a profession was becoming recognized, although very few universities gave place to electrical engineering courses in their curricula. Among those giving instruction in electrical engineering was Columbia University, and after serving in the department Crocker was appointed professor in 1893. It was, therefore, Crocker's privilege and good fortune to help build and guide the fast-growing electrical industry. He devoted many active years to standardization and fire protection work, out of which grew the standardization rules of the American Institute of Electrical Engineering and the National Electrical Code. Being free from family ties (Professor Crocker was a bachelor) he gave liberally of his time in the service of his profession, and the Institute, the Power Club and other electrical associations chose him as president. Prof. Crocker was therefore not without honor in his own country and certainly no greater tribute could be shown to any man, and few were more deserving of it.

Some Desiderata in Superpower Transmission

THE admirable and daring superpower scheme being planned for the North Atlantic States is gradually taking shape. In reporting and planning so colossal an undertaking, however, there is a greater responsibility for certainty and permanence of results than usually rests upon an electric supply system. If the great plan is carried out, there will be reliance on electric power to an extent hitherto unknown, and the fortunes of manufacturing interests within the districts served will rest upon the successful continuity of their power supply. Few people realize to what an extraordinary extent the great interests of the country have, through the manner of their growth, become absolutely dependent on transportation of something or everything, and how easily a little disorganization of this transportation can produce results of the greatest import. The old political economy, based on the idea of free competition in somewhat self-supporting communities, has long since gone by the board. Now a superpower system simply puts transportation of very vital necessity into another form. What men do and what men produce depend then upon electric wires rather than railway tracks. If one were to stop to think what absolute cessation of electric power supply would mean to New York City, he would stand appalled. It therefore will become necessary to plan the great system not only for continuous efficiency but in such wise that no reasonably supposable series of accidental or malicious injuries could put it out of service for any considerable period. It is a case that calls for the most thoroughly worked-out network that ingenuity can devise, so planned that no important point can be accidentally isolated. Much more than a trunk line is necessary—it must be a trunk network.

The Homer Inductive Interference Case

THE relative rights of telephone and electric lighting companies in the use of the public highways has been the subject of needless bickering and strife and of not a little litigation. Fortunately, the National Electric Light Association and the American Telephone & Telegraph Company have taken the question in hand as a matter of public policy, and before long an amicable settlement of all inductive interference troubles may be hoped for. An interesting case, that of the Homer Electric Light & Power Company, has been decided by the Illinois Public Utilities Commission. The decision contains important findings affecting the use of the highways which will give aid and comfort to all electric public utility managers. It is evident that neither the courts nor the commissions will stand for any dog-in-the-manger attitude on the part of any utility, and while it may gladden the hearts of lawyers to pile up precedents, as a practical matter no utility should unnecessarily cumber the records of the courts or the commissions with such cases. The cost of all public utility litigation must be borne eventually by the consumer, and it is therefore to his interest that all differences be adjudicated honestly and expeditiously. The man in the street is not concerned with the technical issues involved, and as a plain business proposition he has little patience with the legal aspects of such cases. To his thinking it is a poor industry that cannot settle its disputes in private.

Appliances and the Diversity Factor

EVERY manager of an electric light and power company who looks ahead beyond the prospects for this year's dividends must have had forced upon his attention the importance of building appliance load for the future. Motor and industrial load of various sorts is always an important element in the growth of output, but it brings with it serious responsibility in the way of station equipment and distribution network. At the present moment the most vital problem in the economics of central-station operation is the full utilization of the

plant and of the copper which has been paid for and laid down. To this end domestic appliances, if properly handled, may become of very great importance. Motors and industrial equipment generally come on at a fairly definite time, lapping the main lighting load with somewhat disastrous results in the late afternoon, and then going off not to reappear until the next morning. The load of minor household appliances, however, presents a diversity factor of rather astonishing value. People do not use vacuum cleaners vigorously in the hour before dinner, nor is the heating pad or the coffee pot likely to go on the line at this undesirable period.

Taking the list of household appliances from start to finish, it offers exceptional advantages in the way of keeping off the peak. Moreover, the use of cooking appliances in particular is likely to fall after the main peak, affecting it only in a slight degree except by increasing the period of fairly heavy load. In general, therefore, there results from the domestic appliance load not only a call for energy off the usual peak, but also, owing to the various habits of customers, an advantage in diversity factor which can hardly be overestimated. Even in the same community and among persons living under approximately similar conditions the diversity factor will usually be found advantageous. For instance, a hundred families living in adjacent apartment houses will prove to be very far from having the same dinner hour, so that, instead of the combined load of all their cooking appliances falling on the system together and at a time when it is already heavily loaded, the aggregate amount is quite certain to be scattered over two or three hours, beginning at the point where the general load has already started to decline. If properly handled, the appliance load will come pretty near to adding itself to the domestic lighting load without material increase of the maximum, and without demanding either more copper or more transformer capacity.

Relation of Boiler Ratings to Performance

THE co-ordination of boiler capacity with peak requirements on the one hand and furnace and stoker design on the other presents today some questions difficult of solution. The old system of rating boilers is, of course, now an international joke, but it still gives a starting point from which to reckon. The relation of boiler rating to performance of the furnace may therefore prove of interest, and it can be studied in detail elsewhere in this issue.

With steady loads steam at minimum cost can probably be obtained with only a moderate output above the regular rating. The more the load varies and the longer the peak, the better it pays to make preparations for operations at big overloads. At these loads the boiler efficiency may drop 5 or 10 per cent, but the requirements can be met without cutting in other boilers which are kept banked or otherwise ready for prompt service.

The point of maximum combined efficiency of boiler and furnace can be widely varied by changing the proportion of the grate area to the heating surface. At low ratings extra-large heating surface raises the efficiency, while with an exaggerated furnace high ratings are helpful. Of course, the grate area is widely influenced by the character of the fuel, so that for steadily efficient operation uniform fuel becomes almost a necessity.

The forcing of boilers, of course, increases the maintenance cost on settings and stokers, particularly if these were not originally designed for high output. The whole story is that not only the boiler but its setting and the stokers must, in order to secure maximum economy, be arranged with overload requirements very clearly in view. Foresight in this respect will always pay.

Surge Protection on Lines and Cables

RADICAL improvements in line and cable protective devices have been somewhat rare of late. In the case of long lines disturbances are now reasonably well handled by the aluminum arrester, improved circuit breakers and the well-known auxiliaries. Conditions are far from satisfactory, however, in the mixed cable and moderate-voltage overhead systems of large centers. Cable breakdowns and losses of transformers and even of machines in these systems are still of frequent occurrence. It is in these cases that the lag of protection behind expansion is most noticeable.

The disturbances in large alternating-current distributing systems usually arise from the mixed character of the lines and equipment. The combination of cables, overhead lines and station machinery results in points of sharp change of the circuit constants, inductance and capacity. Load changes invariably cause some oscillation of stored energy, and the trouble begins when these oscillations or surges are asked to ride smoothly over these humps or sinks in the electric highway.

Recently renewed attention has been given to two old protective devices with the aim to adapt them more exactly to various circuit conditions. It is now proposed to shunt a protective reactance with a relatively high resistance, it being claimed that this will relieve the topmost strain caused by an abnormally steep wave, absorb some of the energy, and so save the coil and the apparatus beyond it. Although there is some difference of opinion as to the accuracy of this reasoning, there seems to be none that a shunted capacity to ground at the ends of cables or lines tends to relieve a voltage rise in much the same way, and this device with series resistance added is now receiving attention.

An account is given in the June number of the *Journal* of the Engineering Institute of Canada of the installation of a number of these so-called absorbers in a large system. The operating data over a period of years show a marked decrease in the number of disturbances which have occurred since the installation of the absorbers.

The theoretical deduction of the phenomena occurring when an electric wave passes over a uniform line and strikes another uniform line with different circuit constants is well known. It is a simple matter to extend this treatment to the case of a shunted condenser at the point of change, and it is almost obvious without resort to the mathematics that such a shunted circuit tends to ease up the steep fronts of both the transmitted and reflected waves. These theoretical deductions are, of course, of the first importance, but it must be remembered that they are only a first and very short step toward the solution of the great problem of disturbances in mixed networks of large distributing systems. In these cases the conditions are so complex as to make it virtually impossible to predict either the character of the initial disturbance or the resultant way in which it will spread through the various points of

discontinuity in the network. Obviously, since these large systems are always the results of growth, the distribution of circuit constants is in large measure beyond control. It appears, therefore, that the present needs of the situation can probably be met to best advantage by a further multiplication of protective devices either of the type mentioned or an improvement thereon.

The Economic Importance of Varied Load

THE usefulness of building up a varied load even in a station of comparatively modest output is emphasized in this issue by E. S. Hamblen. He shows a power load increasing in five years from about 2,000,000 kw.-hr. to nearly 8,000,000 kw.-hr., and the commercial lighting load increasing almost in the same ratio but never reaching a point in the least comparable with the power output. The Franklin (Mass.) plant of which he is writing is clearly in the power business to a very large proportion of its total load, and in spite of loss of motor customers owing to trade conditions, it has been able to keep up its power business with unusual success, because—and here is the point of the whole matter—it has systematically endeavored to obtain as varied a load as local conditions permitted. For instance, it has been able by steady effort to acquire a considerable amount of business in ranges and refrigeration, besides which it operates a municipal pumping plant. Items of this kind mean a large and steady load especially free from fluctuations due to temporary business depression. Appliances have been vigorously pushed, and a deliberate drive has been made for off-peak load by offering special power rates between 11 p.m. and 6:30 a.m. The resulting growth of business has been extremely gratifying, and in particular the stabilizing of income is noteworthy. Electrical supply stations need diversity just as much as does the farming community, although the principle is too often neglected by both classes.

Power Possibilities in Montana

THOSE of our readers who are following hydro-electric development closely will find very much of interest in E. W. Kramer's consideration of the potential power situation in Montana. As has more than once been shown, Montana is rich in water powers, but the present article reports even more wealth than would be anticipated.

The question of utilizing these great powers is chiefly one of demand, for none of the proposed developments presents formidable difficulties from the hydraulic standpoint with our present view of what difficulties mean. In only a few instances would exceptionally high dams have to be built. Montana is certainly a state of magnificent possibilities in the development of power. At present this power awaits an active market, for there is little steam in the state to replace. Here it would seem is a vast power supply for railway electrification when it shall be judged wise to attempt its extension. Some of the transmission lines would have to be long, but the West does not fear this, and the power is undeniably there.

Clark's Fork of the Columbia is by all odds the most important stream for potential power because it has a watershed exceptionally well timbered and provided with lakes, glaciers and perpetual snow in the high mountains to steady its flow. The untouched possibilities on this river aggregate more than 500,000 hp., more than 200,000 hp. being at a single site using Flathead Lake for storage. There is here 187 square miles of water area, and a 30-ft. dam would come near to equalizing the flow in the stream through any ordinary season. The available head is moderate, according to Western notions, but quite sufficient for economical development—about 240 ft. The other Clark's Fork sites are also of moderate head, as are in fact the majority of the Missouri powers, but they foot up to the total of more than 530,000 hp.

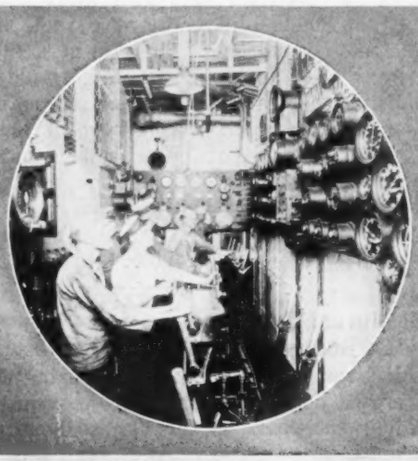
Will Mutual Companies Be Successful?

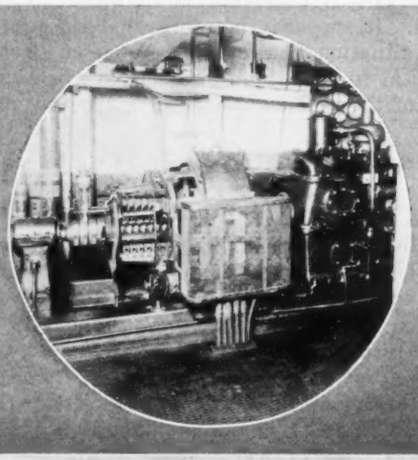
THE rural-service plan for utilizing the energy generated on the Minidoka project, outlined by T. W. Halliday elsewhere in this issue, should be interesting to companies engaged in furnishing such service. However, it should be remembered that this project is not comparable with the ordinary rural-service situation. The Minidoka project was built primarily for irrigation purposes, the demand for such power being limited to the spring, summer and fall months. The Reclamation Service is not in the general utility business, which makes it necessary for some other agency to undertake the distribution of the surplus power. Apparently the plan outlined has been the most feasible so far. The real question is, What is to be the ultimate result of the formation of mutual companies? Will their maintenance be properly cared for? Can these companies with their small means and lack of experience build up the organizations that must be available if the service is to be an ultimate success? Can they continue over a period of years to meet the requirements of the public service commissions successfully? Answers to these questions and many others must be returned before the success of mutual companies can be fully judged. That the plan will result in the rapid building up of a distribution system goes without saying, since it is clearly evident that the farmer is determined to have electric service, be it from the central-station company through his own organization or from a farm-lighting plant.

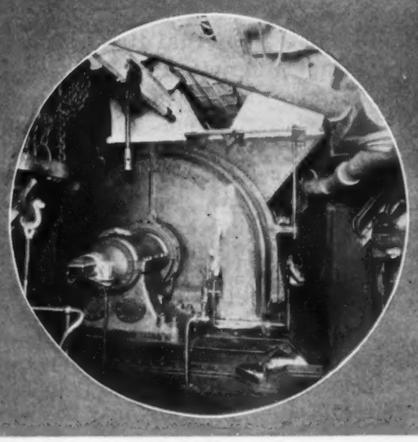
Nickel-Copper Alloy that Has Distinct Magnetic Properties

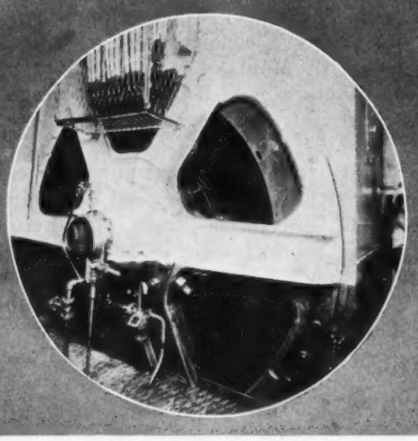
AMONG the more modern nickel-copper alloys is a very noteworthy one, discussed in this issue by Dr. Charles W. Burrows, which is distinctly, although not strongly, magnetic. It has the remarkable property of a very low critical temperature, whereas iron and steel lose their magnetic susceptibility at a temperature that may roughly be described as red heat. The alloy discussed loses its magnetic susceptibility near the temperature of boiling water. That is, it becomes virtually non-magnetic at and above 100 deg. C., but regains its magnetic properties when its temperature is lowered a few degrees below the critical point. The alloy is not easily corroded by exposure, may be cast into molds and possesses considerable strength. As the article points out, such a magnetic material has many useful applications. Because the metal is neither strongly magnetic like steel nor very weakly magnetic like certain compounds of iron, a special testing technique becomes desirable for it. The methods worked out and briefly described by Dr. Burrows are noteworthy.

Freedom of Layout Permitted with Electric Drive









THE electrically propelled battleship "Tennessee" has recently completed her official trial tests. Her fuel economy was 10 per cent better than promised and she was brought from full speed (21.4 knots) to a dead stop in less than three minutes. While stress has been laid on economy of electric drive and has been justified, the greatest advantage is its freedom of layout and flexibility of control.

Rural Service in Southern Idaho

History of Methods Adopted, Rates of Mutual Companies and Type of Line Construction Employed in This District—Distribution Systems Growing Rapidly

By T. W. HALLIDAY
Engineer Rupert (Idaho) Electric Company

THE plan for handling rural extensions that has been in successful operation for several years on the Minidoka Project in southern Idaho is of interest because of the satisfactory solution of the problem it has afforded under the conditions existing and for the contrast it affords to the Wisconsin method as outlined by G. C. Neff in the Dec. 18, 1920, issue of the ELECTRICAL WORLD, under the title of "Factors Governing Rural Extensions." This plan has been approved by the Idaho Public Utilities Commission.

The Minidoka Irrigation Project, constructed by the United States Reclamation Service, furnishes water for 121,057 acres (299,000 hectares) of land, of which 72,093 acres (178,000 hectares) are under gravity systems and 48,964 acres (131,000 hectares) are under pumping plants. Primarily to take care of the pumping system, a power plant of 10,000 hp. rating was built. As towns grew up on different portions of the project the Reclamation Service ran transmission lines to them and furnished power for all general purposes, including heating. The latter service is possible only because the main portion of the rating of the power plant is used for pumping during the irrigating season, which falls in the summer months and furnishes a surplus of power during the remainder of the year.

In 1910 a contract was entered into between the Reclamation Service and the village of Burley and with individuals in Heyburn and Rupert whereby power should be delivered to substations in each locality. From these points the distribution was to be handled by the village or individual. As the surrounding country developed a demand for rural service grew up. At first lines were run from the various substations installed to handle the villages, but as the practicable limit of 2,200-volt distribution from these points was reached the Reclamation Service engineers worked out a plan of building outdoor substations along the 33,000-volt transmission lines to make 2,200-volt energy available at various points. Mutual companies were then organized among the farmers to contract for the power at wholesale rates and to build and operate distribution lines to serve the members.

There are 2,275 farms on the Minidoka Project, and at the present time the rural service extends to 1,160, or about 51 per cent of the total number. The distribution system embraces 265 miles of pole line carrying single or three-phase service. In serving the 1,160 customers the lines make service available to a total of approximately 1,750 farms. The percentage of saturation—that is, the ratio of farms served to the farms capable of being served by the existing lines—is therefore approximately 65 per cent.

The state laws of Idaho provide for the formation of mutual or co-operative incorporations, which are to be conducted without profit and wherein each member has equal voice and right. The rural electric companies are organized under these laws. The membership fee of these mutual companies is set by assessing the pro rata cost of the initial construction of the distribution line to each of the original members, and this fee must be paid by all succeeding additional members. Clauses governing this fee and the requirement that only members of the company be served from its lines are made a part of the bylaws. All service wires, transformers and other equipment utilized only to serve the individual member are the property of that member and are paid for by him. An extract from the bylaws of one of these companies indicates the general method of handling these matters:

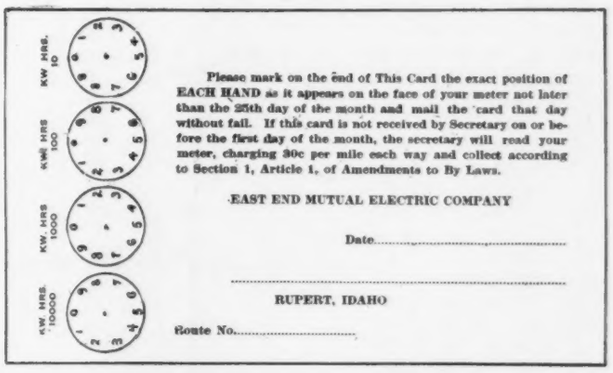

KW. HRS. 10
KW. HRS 100
KW. HRS 1000
KW. HRS. 10000
Please mark on the end of This Card the exact position of EACH HAND as it appears on the face of your meter not later than the 25th day of the month and mail the card that day without fail. If this card is not received by Secretary on or before the first day of the month, the secretary will read your meter, charging 30c per mile each way and collect according to Section 1, Article 1, of Amendments to By Laws.
EAST END MUTUAL ELECTRIC COMPANY
Date.....
RUPERT, IDAHO
Route No.....

FIG. 1—STAMPED POST CARD USED BY RURAL CUSTOMERS IN REPORTING METER READINGS

The initial membership fee in this company shall be $———. This fee may be increased or decreased by the board of directors from time to time as they find necessary, except that no person may receive service under a more favorable condition than the other members. In case the expenditure necessary for the company to make in serving a new member is greater than the membership fee, then the member shall be required to pay such additional amount as shall be necessary and as shall be determined by the board of directors, but under no condition will the company be required to carry the primary line to a point closer than ——— feet from the member's house, except at said member's expense.

No person may receive service from the lines of the company unless he is a member and has paid all fees and has complied with such other requirements as the board of directors may prescribe. No member shall receive service upon more than one farm unit or other property unit except by payment of such additional fee as may be determined by the board of directors.

OPERATION AND RATES OF MUTUAL COMPANIES

Like ordinary corporations, the business of the mutual companies is handled by a board of directors, but the secretary-treasurer is usually the active managing agent. Upon him falls the duty of rendering statements, making collections for services, supervising the maintenance of the system and generally enforcing the rules and regulations of the company.

When a public utility serves a territory oftentimes too great a portion of its consumers do not realize that their failure to co-operate with it only causes additional expense of operation which they must ultimately pay. This lack of harmony is reflected in the rates that must be paid, as the overhead expense of the utility is greatly increased to the detriment of all concerned. In the mutual organization, however, each member is his own as well as his brother's keeper, and the overhead expense of service is very small. The direct method used by the mutual companies to accomplish this result will be apparent by quoting from the "rules and regulations" used:

No. 1. All dues and charges for electrical energy shall be due and payable at the office of the treasurer on or before the tenth day of each month following that month in which the same is used or a service charge accrues, and if not so paid a collection charge of 10 per cent shall be added. If said charges and dues together with said collection charge are not paid before the first of the month following the assessment of said collection charge, then it shall be the duty of the treasurer, or of some person by him authorized, to shut off the electrical energy of such delinquent until such charge, dues and collection charge, together with all costs of disconnecting service and reconnecting same, are paid in full, and he shall have the right to go upon the premises of such delinquent member for such purpose and remove the plugs from the transformer, or such other means as he shall deem proper.

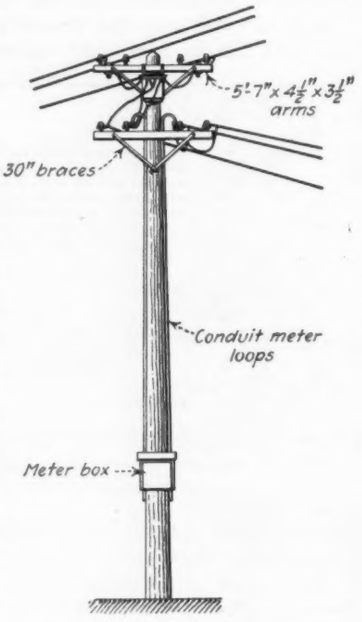


FIG. 2—TYPE OF RURAL SERVICE POLE-LINE CONSTRUCTION EMPLOYED IN SOUTHERN IDAHO

No. 2. Every member of this association shall remove all obstructions along his line of service and along his farm or premises which interfere with the wires running to and from the same, upon notice from the secretary, and if the same be not so removed within ten days from and after date of such notice, it shall be done by the company and all charges therefor shall be paid by such member and collected in the manner provided in rule No. 1.

No. 4. Each member shall read his own meter and shall report the same to the secretary on cards to be furnished by the secretary and shall mail said report to the said secretary on or before the twenty-fifth day of each month, and upon failure so to do the secretary shall upon the first day of the month read said meter or meters and charge all expense up to such member at the rate of 30 cents per mile or fraction thereof going to and coming from his place, and such charge shall be collected in the manner provided in rule No. 1.

While the rates of the different mutual companies vary slightly, virtually all of them use a sliding scale which falls within the following limits:

Minimum charge for first 15 kw.-hr. to 50 kw.-hr. use	$1.00 to $2.00	per month
Next 100 to 150 kw.-hr. per month.	0.03 to 0.05	" kw.-hr.
Balance used during the month....	0.01 to 0.015	" kw.-hr.

These rates have been found sufficient under this form of operation to meet all operation and maintenance and to lay aside a fund to meet accruing depreciation.

WHOLESALE RATES

The wholesale rate now used by the Reclamation Service is a combination of a demand charge plus a kilowatt-hour charge which follows a sliding scale and to which a discount schedule is applied. This gives a rate of sufficient flexibility to serve contracts from the smallest mutual company to the larger municipalities and also allows any company served to sell at wholesale to any smaller organization, or to one of its own size, at a profit by simply applying this same schedule. In fact, the Reclamation Service contracts provide that all resale on a wholesale basis must follow this rate.

As is usually the case in developing a new form of distribution, these rates were not conceived in their present form but are the result of evolution. At first all service was on a flat-rate basis. This gave way to a metered basis wherein the meter readings of the individual consumers were taken and a differential applied to leave an operating margin for the distributer. Under this plan separate metering of each class of service was required and a separate rate was applied. The present schedule permits all service to be metered together. A synopsis of the Reclamation Service rates is given in the following paragraphs:

The contractor will pay monthly for energy used as follows:

(a) For equivalent of first 50 hours' use of maximum demand, $2 per kilowatt of maximum demand.

	Per Kw.-Hr.
(b) For equivalent of next 50 hours' use.....	$0.03
(c) For equivalent of next 50 hours' use.....	0.02
(d) For equivalent of next 150 hours' use.....	0.01
(e) For remainder of energy used.....	0.005

The above rates will be increased 25 per cent during June, July and August. (This is to discourage commercial loads from building up the peak during the pumping season.)

Quantity discounts varying from 2 per cent for an agreed maximum demand of 2 kw. to 30 per cent for an agreed maximum of 100 kw. are applied. An additional discount of 10 per cent is allowed if electricity is delivered and metered at 2,200 volts.

In the winter months the surplus capacity of the plant is sold for heating purposes at a flat rate of $1.25 per kilowatt per month, but this service must be delivered over separate lines and is subservient to all other demands for service.

The Idaho Power Company is contemplating two forms of rate for this class of service, one very nearly following the Reclamation Service rate, except that the 25 per cent increase for the summer is more evenly distributed over the entire year, and the other a modification of its irrigation pumping rate. In the final analysis both rates yield about the same monthly charge when applied to the average rural or small municipal organization.

RURAL DISTRIBUTION LINES AND TYPE OF CONSTRUCTION USED

All distribution lines must conform to the standards of construction of General Order No. 10 of the Public Utilities Commission of Idaho and are subject to approval and acceptance by the wholesaler. The standard voltage of the Reclamation Service is 2,200, either single-phase or three-wire three-phase, while the standard of the Idaho Power Company is 11,430/6,600 volts, four-wire, three-phase.

At either voltage the ridge-pin type of construction is discouraged and four pin arms are used throughout, as this provides for greater flexibility in the 2,200-volt lines and is essential in the 11,430/6,600-volt system.

For the lighter loaded lines iron wire is used extensively. As a system develops it is necessary to convert the trunk lines to copper and the iron is then transferred to the branches. Under the mutual form of organization it will be seen that new members do not pay any portion of the cost of the lines already built if the cost of their extension exceeds the membership fee, but it has become the custom that should the addition of these members increase the loading of the existing line to such an extent that the service of the original members may become impaired, then such new members must replace the trunk line serving them with heavier wire. The wire removed is available to them for use of the extension.

Under general order No. 10 of the Idaho Public Utilities Commission the practice of using a distribution pole with a secondary bracket is not permitted. This order provides that a clear space of at least 30 in. (75 cm.) between pole pins must be maintained on this service.

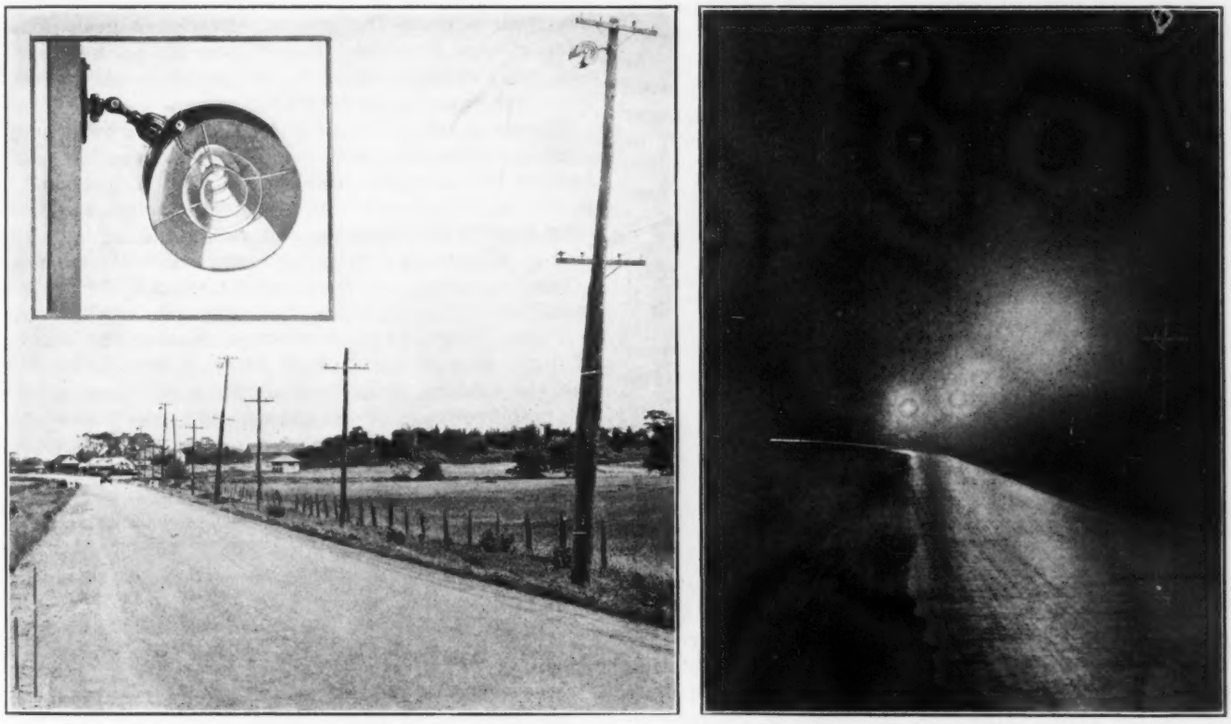
Since the rates in general use permit the combined metering of all classes of service, the general custom is to place the meter in a box on the distribution pole. By giving this pole a central location it is possible to serve all portions of the premises with a minimum amount of service wires.

For the ordinary farm load, such as lamps and house pump, flatiron and other lamp-socket appliances, a standard watt-hour meter is used, but where larger motors, ranges and similar devices are connected a demand type of meter is usually employed. In lieu of the latter a minimum charge is sometimes applied in conjunction with the watt-hour meter and is based upon the estimated monthly demand.

Highway Lighting Reduces Hazard Due to Glaring Headlamps

WITH a view toward reducing the possibility of automobile accidents due to glaring headlights, an experimental installation of highway lighting with a new type of unit has recently been made on the Paradise Road, Swampscott, Mass. It has been said that a large percentage of the night automobile accidents can be ascribed to headlight glare, although many types of headlight reflectors have been developed which were supposed to eliminate or at least reduce this glare. The present plan of lighting the country highways, particularly dangerous curves, so that the use of headlamps will be unnecessary is said to decrease this accident hazard.

The new type of apparatus which has been developed by the General Electric Company for highway use consists of a nest of reflectors, one within the other. Two of these nests direct the light toward the roadway at an angle of 10 deg. below the horizontal. There is also some light directed below the unit owing to the opening just below the tip of the lamp. The bracket holding the reflector is adjustable in both vertical and horizontal directions so that the fixture can be mounted on poles close to the edge of the highway or at locations which may be some distance away from the roadway. The units are designed for a gas-filled lamp and are supposed to be placed at a height of about 30 ft. (9 m.) above the road and from 400 ft. to 600 ft. (120 m. to 180 m.) apart.



HIGHWAY LIGHTING THAT REDUCES THE DANGER OF AUTOMOBILE ACCIDENTS AT NIGHT

Several communities have already became interested in this method of highway illumination and plan installations of the new units for experimental purposes so that the advantages of highway lighting may become known. Eventually it is felt that such lighting improvements will be apportioned as a part of the expense of highway work and will be taken up by the state. It is

thought that this is an improvement to traffic just as essential as a smooth road surface. There is little doubt that the rural communities would also benefit from the development of highway lighting as it would open up new possibilities for rural service and electricity on the farm.

Economic Value of Load Diversity

Stable Earnings of Companies that Have Built Up a Small-Appliance Business and Paid Attention to Municipal Pumping, Refrigeration and Industrial Heating

BY E. S. HAMBLEN
Manager Union Light & Power Company, Franklin, Mass.

WITH the ever-increasing applications of electrical energy for industrial, chemical, manufacturing and domestic purposes the central-station company is enabled to build up a more diversified load, thereby filling up some of the valleys and smoothing out the peaks in its daily load curves. Ten years ago the word "power" brought to the mind of the average manager of a small central station the picture of a mill or factory having a connected load of not more than 100 hp. in motors. Today he thinks of the power load as being made up of motors, industrial heating, electric furnaces, ranges, water heaters and many other energy-consuming devices. With this great change in the past ten years, what will the next decade bring forth? It is the duty of every manager to keep ahead of his organization, and by studying the results of the past he can forecast with some degree of accuracy the trend of future developments.

In obtaining any class of new business or soliciting old customers for additional business the question of cost enters largely into the negotiations. Although the electric light and power company is regarded as having a monopoly in the community, in reality it has competition in lighting from gas and oil and in heating from gas, oil, wood and coal. To procure power business it must be able to quote a rate low enough to compete with isolated-plant costs. While there are many sound arguments in favor of central-station service at a slightly higher cost, this difference must not be too great. However, regulated as the central-station rates are by public service commissions, there is little likelihood of anything but a fair and equitable rate being quoted to any power customer.

To maintain a steadily increasing income and earn sufficient revenue to meet the interest on its outstanding securities through periods of depression a company must develop all available classes of business. The more diversified the load the more stable are the earnings of the company. If, for instance, it devoted all its efforts to obtaining new power business, the company's earnings would be large when general business conditions were good, but the company would be unable to pay dividends during business depression because of heavy interest charges on that part of its investment which was idle. Many companies try to offset this by a monthly service charge of $1 or more per horsepower, and while a power customer knows that he would have to stand the fixed charges on his own plant, he dislikes paying money to the central-station company during a time when "it's all going out and nothing coming in."

A few figures shown in Table I on the kilowatt-hour output of the writer's own company are suggestive. The ratio of increase in power and lighting is fairly consistent during the five-year periods. This is because of the fact that we make no especial effort to obtain any one class of business, or, more correctly, we make particular effort to get every class of business.

TABLE I—KILOWATT-HOUR OUTPUT FOR FIVE-YEAR PERIOD

Year Ended July 1	Kilowatt-Hours Power	Kilowatt-Hours Lighting
1916	2,258,371	263,986
1917	3,892,740	313,045
1918	5,825,871	410,552
1919	6,583,398	449,401
1920	7,867,732	600,901

Years ago it became evident that the central-station company could not depend upon lighting alone to make commercial and residential business profitable. This company has actively pushed the sale of electric appliances, and in certain territories particular attention has been paid to the sale of electric ranges. These offer a very profitable load if several can be sold in one neighborhood so as to be served from the same transformer and secondaries.

The value of a diversified load has been well demonstrated within the past year. During the last eight months this company suffered a loss of 27 per cent on power business because of industrial conditions. However, largely on account of our range and refrigeration load and municipal pumping, our ratio of operating expense to gross revenue was within 2.5 per cent of last year.

Table II, which gives a comparison of the number of lighting customers, total kilowatt-hours consumed and the average annual consumption per customer for the past five years, shows the results of the sale of electric appliances. Daylight saving has no terror for the company with a good appliance load on its lines.

TABLE II—EFFECT OF APPLIANCE SALES ON LIGHTING LOAD

Year Ended July 1	No. Lighting Customers	Kilowatt-Hours Lighting	Average Kilowatt-Hours per Customer
1916	1,422	263,986	186
1917	1,562	313,045	200
1918	1,604	410,552	256
1919	1,726	449,401	260
1920	1,951	600,901	308

We write to all of our power customers about once in three months notifying them of any change in the policy of the company, changes in or additions to generating equipment, further "tie-ins" for the betterment of the service, and any other items which would be of interest and which would develop better relations with customers.

Our company has made an effort to build up its off-peak load and offers special rates for power service from 11 p.m. until 6:30 a.m. A great deal of progress has been made in industrial heating in the last five years, and as this is a twenty-four-hour load in many cases it should soon be a very profitable business. From our experience we consider municipal pumping, electric ranges and refrigeration to be the best classes of load, as the income is nearly constant regardless of industrial conditions. These, together with industrial heating, which will require considerable missionary work, particularly in the smaller cities, seem to offer the best opportunities for building load and revenue for the small central station.

Hydro-Electric Possibilities in Montana

Total Water Power Available Placed at Approximately 1,000,000 Hp., of Which 225,000 Hp. Has Been Developed—Study of the Four Principal Watersheds Showing Possible Developments of Over 10,000 Hp.

By E. W. KRAMER,
Hydro-Electric Engineer United States Forest Service, Missoula, Mont.

A STUDY of the possible development of water power in Montana shows that the four principal watersheds in that state should develop 1,000,000 hp., of which approximately 225,000 hp. is being utilized at the present time. As emphasized later in this article, the development of these resources naturally will depend upon the demand for power and the economy of its utilization. The principal uses for power lie in the mining industry and the electrification of trunk-line railroads. Other uses that either are developing or will probably materialize are electrometallurgical plants, irrigation, paper mills and possibly the fixation of atmospheric nitrogen.

Montana has four large rivers of prime importance, the Missouri and Yellowstone east of the Continental Divide and the Clark's Fork of the Columbia and the Kootenai west of the divide. The last named stream entering the northwest corner of the State from British Columbia, cuts across the northwest corner for a distance of about 90 miles. Both the maximum and minimum flows are about equal to those of the Missouri River at Great Falls, Montana. The Clark's Fork of the Columbia with its tributaries drains all of Montana west of the divide except the small area drained by the Kootenai and has a watershed area of 22,000 square miles (57,000 sq.km.). At the point where it leaves the state the Clark's Fork has a stream flow much greater than any other stream of the state. Its watershed is well timbered, and it includes several lakes and glaciers and numerous ranges on which there is snow for the major part of the year. The proportion of valleys to mountains in this area is small. The stream has the most uniform flow of the large streams of the state, due largely to the timbered areas, lakes and snow fields. There are a number of power sites in the Clark's Fork watershed in Montana of the premier class totaling more than a half-million horsepower. These nearly all lie between Flathead Lake, elevation 2,890 ft. (881 m.), in Montana and Pend Oreille Lake, elevation 2,050 ft. (624 m.) on the Clark's Fork River in Idaho near the Montana line. Of this 840 ft. (256 m.) drop it will probably be feasible to develop 632 ft. (192 m.) in nine projects.

There is one power site of prime importance in the Yellowstone watershed in Montana, the Big Horn Canyon site, about 30 miles (48 km.) above Hardin. There are other smaller sites the principal one of these being the Buffalo Rapids site below Miles City.

In point of area drained and in point of developed power projects the Missouri River is the most important stream in the state, though not in point of power possibilities or stream flow. The Missouri and its four tributaries receive all the drainage from the east slope of the Continental Divide in Montana from the Yellowstone Park to Canada. Along the Missouri River and the Madison, which is the largest of the three streams forming the Missouri, there is almost a continuous chain of developed and undeveloped power sites from the Hebgen Reservoir, near the Yellowstone Park, to Fort Benton. The Gallatin has one or two undeveloped sites of secondary importance. The Jefferson, including its principal tributary, the Big Hole, has one developed site near Divide, Mont., known as the Big Hole plant of the Montana Power Company, with an installed capacity of 4,000 hp.; but with this exception it cannot be considered a power stream. The Sun River has power possibilities. These, however, are tied in with United States reclamation projects to such an extent that their development by private capital is unlikely.

In a study of the water power of Montana, including only projects with capacity of 10,000 hp. or more of primary power, all streams except the Clark's Fork, Flathead, Kootenai, Big Horn, Madison, Missouri and Yellowstone can be eliminated.

STORAGE POND ABOVE THE THOMPSON FALLS ON CLARK'S FORK

Beginning with the Madison and Missouri, which can be considered as one stream, it appears practicable to develop 1,740 ft. (530 m.) of the total 3,700 ft. (1,127 m.) of fall between the Hebgen Reservoir, elevation 6,500 ft. on the Madison (1,980 m.), and Fort Benton, elevation about 2,800 ft. (853 m.), the head of navigation on the Missouri, in probably fourteen projects. Seven of these are now developed and operated by the Montana Power Company* with a total head of about 628 ft. (209 m.). Hebgen reservoir has a capacity of 345,000 acre-feet (425,000,000 cu.m.) and an area of about 13,500 acres (5,460 hectares). The water can be controlled through a vertical distance of 60 ft. (18 m.). The capacity is almost sufficient for complete regulation of the flow of the Madison River from years of great run-off to years of small run-off, with the object in view of keeping the combined minimum power capacity of the sites, utilizing the water below, at the

See p. 1041, May 8, 1920, ELECTRICAL WORLD.

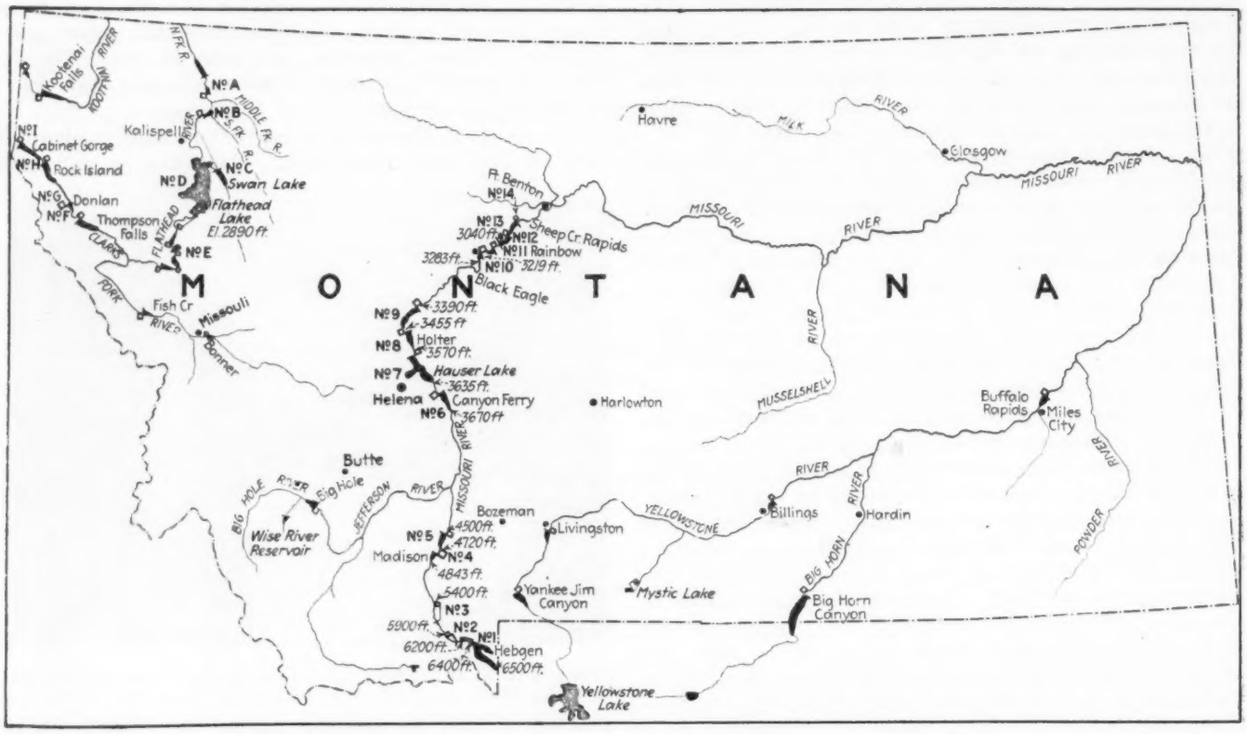
highest possible figure. The flow of the Madison River into the reservoir varies from an extreme minimum of about 400 sec.-ft. (11.3 cu.m. per second), the minimum usually occurring in February, to an extreme maximum of 7,000 sec.-ft. (198 cu.m. per second), the maximum usually occurring in June.

For the purposes of reference, the undeveloped and developed sites along the Madison and Missouri Rivers are numbered beginning below the Hebgen Reservoir. In all cases the power capacity of the site given is the primary power that can be developed considering the Madison and Missouri River plants as in one system. For this reason the figures given in the table under developed water powers may not agree with the actual ratings installed.*

Projects Nos. 1, 2 and 3 are not particularly attractive compared with other undeveloped sites on account of the great length of conduit required for the head obtained, on account of their altitude (which, with the accompanying extreme cold, when the power would be needed most, would cause trouble with any kind of open conduit) and on account of their distance from a market.

Project No. 1, undeveloped, would require a low dam diverting the Madison River shortly below the Hebgen dam, at elevation about 6,400 ft. (1,950 m.) into a tunnel on the north bank of the stream, which would conduct the water for a distance of 6 miles (9.6 km.), returning it to the Madison River at a point where the stream leaves its upper canyon at elevation 6,200 ft. (1,889 m.), where a head of about 170 ft. (5 m.) could be developed. The capacity of this plant should be figured with a flow of about 1,000 sec.-ft. (28.4 cu.m. per second) and a 170-ft. head in estimating the total primary power of projects on the Madison and Missouri Rivers. This will give a capacity of 14,000 hp. Project No. 2, undeveloped, would require a low dam diverting the Madison River below the No. 1 power house, at about elevation 6,200 ft., into a conduit about 7 miles (11 km.) long which could be located on supporting ground and would develop a head of about 250 ft. (76 m.). In estimating the capacity of the system, the flow can be considered 1,000 sec.-ft., as in the case of the No. 1 project, and the head 250 ft., which gives a capacity of 20,000 hp. Project No. 3, undeveloped, would divert the Madison at a point about 9 miles (14 km.) below the No. 2 power house at an elevation of 5,600 ft. (1,706 m.), returning the water seven miles below at elevation 5,400 ft. (1,645 m.). The capacity of the site would be about 12,000 hp.

Projects Nos. 4, 6, 7, 8, 10, 11 and 13 are already developed, although in some cases they are not up to the maximum capacity which could be obtained. As shown in the table for these developments, there is some additional capacity available.



PRINCIPAL DEVELOPED AND UNDEVELOPED WATER-POWER SITES IN MONTANA

Project No. 5, undeveloped, may consist of a dam about 200 ft. (61 m.) high, if proper foundations are found, built about 10 miles (16 km.) below the No. 4 power house, backing water up to an elevation of about 4,720 ft. (1,438 m.) and developing a head between the elevations of 4,500 ft. (1,371 m.) and 4,720 ft. (1,432 m.). It would probably have a short conduit below the dam. A net head of about 215 ft. (65 m.) would be developed. The wheel capacity should be about 2,250 sec.-ft. (64 cu.m. per second), and the power capacity, figuring as heretofore, can be taken as 30,000 hp. This is the last site on the Madison River.

There is an undeveloped site, project No. 9 on the Missouri River between the Holter plant and the developed Great Falls sites, which is about 10 miles (18 km.) up stream from Cascade, Mont. A head of 60 ft. (18 m.) can probably be developed with the maximum elevation of flashing at 3,455 ft. (1,050 m.). The project probably would consist of a dam 50 ft. (15 m.) high

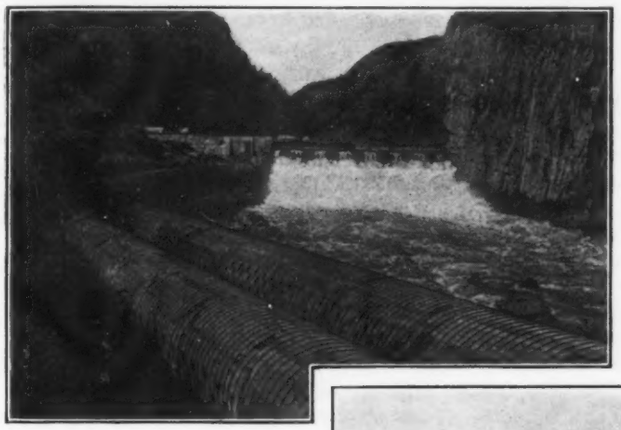
*The developed water powers of this system were covered in the May 8, 1920, issue of the ELECTRICAL WORLD.

above low water with 10 ft. (3 m.) of flashing, which would make considerable storage available. The capacity would be about 17,000 hp.

An undeveloped project No. 12 is located midway between the Rainbow and Volta plants. A 60 ft. (18 m.) dam furnishing a 67-ft. (20 m.) head on this site would develop 21,000 hp.

Another undeveloped project No. 14 is located 4½ miles (7 km.) below the Volta plant. A dam 36 ft. (11 m.) high will give a head of 70 ft. (21 m.) at the plant. The capacity would be 22,000 hp.

All of the developed projects belong to the Montana Power Company and are connected by transmission lines operating at 65,000 volts and 110,000 volts. The Montana Power Company has other plants of a capacity less than 10,000 hp. on this system, which have not been mentioned, and a plant at Thompson Falls, on the Clark's Fork, with 40,000 hp. installed, which will be considered later.



The Madison plant of the Montana Power Company, a 12,000-hp. development listed as project No. 4 in the table on page 114. Two wood-stave conduits 7,600 ft. long, one 10 ft. in diameter and the other 12 ft. conduct the water to the forebay. Ten miles below this plant is an undeveloped site for a possible development of 30,000 hp.

A point on the Missouri River below Great Falls where a dam can be built 60 ft. high and 1,000 ft. long which would allow for the development of approximately 30,000 hp.

It is not believed that there are any power projects along the Yellowstone River proper in Montana above the mouth of the Big Horn of a capacity as great as 10,000 hp., unless the Yellowstone Lake in the Yellowstone Park shall be used for storage purposes. A head of 60 ft. (18 m.) could easily be developed at the Yankee Jim Canyon about 15 miles (24 km.) below the point where the stream leaves the park, but since the mean monthly stream flow gets as low as 1,000 sec.-ft. (28.4 cu.m. per second) the capacity of the site would not be over 5,000 hp. The Montana Power Company has a plant with 22 ft. (6 km.) head and about 2,000 hp. capacity at Livingstone and another at Billings with a 20-ft. (6.1-m.) head and about 3,000 hp. capacity. Possibly 10,000 hp. of primary power could be developed at the Buffalo Rapids near Miles City when the storage involved in the Big Horn project is developed. Plans for the development of the Buffalo Rapids project have been made. It is intended to build a dam 13 ft. high above the upper rapids just below Miles City, and to develop a total head of 21 ft. The power will be used primarily for irrigation, and since the peak demand will not occur during the low flow period, it is intended to develop 15,000 hp. There are other rapids along the stream where low head projects similar to the Buffalo Rapids project can be developed. However, it is thought that their primary capacities are not much if any greater than 10,000 hp.

On West Rosebud Creek in the Yellowstone watershed, about 60 miles (96 km.) southwest of Billings, there is a high-head project just below Mystic Lake. The regulated head of 97 sec.-ft. (2.7 cu.m. per second), with an effective head of 1,094 ft. (332 m.), will develop 8,500 hp. This project has been described, even though the capacity is less than 10,000 hp., for the reason that the development is comparatively easy, that it is in a part of the state where power sites are not so plentiful as farther west, and because, with an overdevelopment, the project would lend itself admirably to carrying fluctuations in load occurring in any large system.

The only large power site in eastern Montana is the Big Horn Canyon site on the Big Horn River, about 30 miles (48 km.) above Hardin. The capacity of the project is dependent on the height of dam that it would be practicable to construct in the canyon. Dams as high as 480 ft. (146 m.) have been considered. The foundation and abutments for a high dam appear to be excellent. A 250-ft. (76-m.) dam would develop about 46,000 hp. and a 480-ft. (146-m.) dam about 100,000 hp. of primary power. The latter would be 1,300 ft. (396 m.) long on top and about 160 ft. (48.7 m.) long at the base. This site may play a very important part in railway electrification on account of its location, it being the easternmost site of any size in Montana. It could be used to electrify the Chicago, Milwaukee & St. Paul Railway from Harlowton, Mont., the present eastern terminus of the electrified section, as far east as transmission is feasible, and to electrify the Northern Pacific from some point about Livingston, Mont., as far east as transmission is practicable.

Mystic Lake, on the Yellowstone, offers storage for an 1,100-ft.-head development with a capacity of 8,000 primary horsepower.

As shown in the table, the developments along the Clark's Fork and the Flathead Rivers offer a possibility of developing 578,500 hp., which with the 42,500 hp.

already developed would total 621,000 hp. For reference, the developed and undeveloped power sites on this watershed, which is west of the Continental Divide, have been designated with the letters of the alphabet, proceeding from the Flathead and Clark's Fork and from the mouth of the Flathead. There is only one project of 10,000 hp. capacity on the Clark's Fork above the Flathead. This is the Fish Creek site and will be referred to by name only. The site at Bonner, with an installed rating of 3,200 hp., which supplies Missoula, is developed and is the property of the W. A. Clark Power Company.

Project A would consist of a power dam on the North Fork of the Flathead at a point one-half mile above the mouth of Canyon Creek and a storage dam and reservoir 8 miles (13 km.) above. The dam power would be 145 ft. (44 m.) high above low-water level and 525 ft. (160 m.) long at the top. The capacity would be 30,000 hp. The site for the storage dam is somewhat questionable on account of the foundations. The dam would be 140 ft. (42 m.) high and 1,250 ft. (381 m.) long.

DEVELOPED AND UNDEVELOPED WATERPOWER ON FOUR PRINCIPAL WATER SHEDS

Name	No.	Undeveloped, Hp.	Developed Hp.
MISSOURI AND MADISON			
.....	1	14,000	.....
.....	2	20,000	.....
.....	3	12,000	.....
Madison	4	4,000	12,000
.....	5	30,000	.....
Canyon Ferry	6	.....	12,000
Hauser	7	.....	20,000
Holter	8	.....	31,000
Cascade	9	17 000	.....
Black Eagle	10	.....	13,000
Rainbow	11	.....	36,000
.....	12	21,000	.....
Volta	13	.....	49,000
Sheep Creek	14	22 000	.....
Total		140,000	173,000
YELLOWSTONE			
Yankee Jim Canyon	..	5,000	.....
Livingston	..	.....	2,000
Mystic Lake	..	8,000	.....
Billings	..	1,560	1,440
Big Horn Canyon	..	100,000	.....
Buffalo Rapids	..	5,000	.....
Total	..	124,560	3,440
CLARK'S FORK*			
North Fork Flathead	A	30,000	.....
Coram	B	12,000	.....
Swan River	C	5,500	2,500
Polson	D	205,000	.....
Lower Flathead	E	82,000	.....
Thompson Falls	F	20,000	40,000
Donlan	G	48,000	.....
Rock Island	H	60,000	.....
Cabinet	I	92,000	.....
Fish Creek	J	24,000	.....
Total		578,500	42.500
KOOTENAI			
Kootenai Falls	..	20,000	.....
Leonis	..	11,000	.....
Total	..	31,000	.....

* Calculated on basis of 30 ft. storage in Flathead Lake.

The Project B is on the Flathead River near Coram, Mont., about one-fourth of a mile (0.4 km.) below the mouth of South Fork. The Great Northern Railroad runs along the north bank of the Flathead River at the site. It is not known at what depth bedrock could be found at the south abutment or in the stream bed, but if satisfactory foundations were found, it would be feasible to construct a dam 90 ft. (27 m.) high above the low-water level, which would be 700 ft. (213 m.) long on top. The maximum capacity of the site would be about 12,000 hp.

Project C is on the Swan River at Big Fork and includes Swan Lake. The capacity available at this site including storage in Swan Lake is placed at 8,000 hp., of which 2,500 hp. is already developed.

Project D is the most important of the possible developments on either of these two rivers, totaling 205,000 hp. This project involves using Flathead Lake as a storage reservoir and the development of a fall of about 240 ft. (73 m.) in the 10 miles (16 km.) of stream below the lake, probably by means of a 186-ft. (56 m.) dam and a 53-ft. (16 m.) dam or one 50-ft. (15 m.) diverting and storage dam near the lake outlet, a 4-mile (6 km.) tunnel and a second 50-ft. dam. Without storage the minimum capacity of the projects would be 51,000 hp.

WHAT STORAGE WILL DO IN FLATHEAD LAKE

With storage in Flathead Lake between the mean high and low water marks the capacity would be 113,000 hp., the water being controlled through a vertical distance of 9 ft. (2.7 m.). The area of Flathead Lake is 187 square miles (485 sq. km.), with a long shore line. A dam 30 ft. (9 m.) high above mean low water would about equalize the flow in the stream throughout the ordinary year and would give a capacity of 205,000 hp.

Between the lower power house of Project D and Paradise, Mont., it would probably be feasible to develop as Project E a fall of 175 ft. (53 m.) in four sections, consisting of four dams across the Flathead River. Their combined capacity without storage in Flathead Lake would be 37,000 hp. With storage of 9 ft. (2.7 m.) between mean high and low marks their capacity would be 82,000 hp. With 30 ft. (9 m.) of storage, their capacity would be 150,000 hp.

Project G, undeveloped, is known as the Donlan site. It is located about 6 miles below Thompson Falls. A head of 40 ft. can be developed by means of a dam. The capacity is 20,000 hp. without storage and 48,000 hp. with 30 ft. of storage in Flathead Lake.

On the Clark's Fork River near Noxon, Mont., about 35 miles (56 km.) below Thompson Falls is undeveloped Project H which is known as the Rock Island Gorge. The stream at this point runs over a rock ledge dividing into two channels around a rock island. The abutments are of ledge rock. The channels are 550 ft. and 400 ft. (167 m. and 122 m.) wide at an elevation 50 ft. (15 m.) above the low-water level. The width of the channels at low water level are 250 ft. and 150 ft. (76 m. and 45.7 m). The power house would be located at one end of the dam. A 50-ft. head at this point would develop about 25,000 hp. without storage and 60,000 hp. with 30 ft. (9 m.) of storage in Flathead Lake. The dam at Rock Island would probably develop enough pondage for daily regulation, but no storage.

RAILROAD RIGHT-OF-WAY LIMITS CABINET GORGE DEVELOPMENT

The Cabinet Gorge site on the Clark's Fork River in Montana near the Idaho line is known as Project I and is undeveloped. The precipitous rock walls of the canyon are 115 ft. (35 m.) high above low-water mark. The width of the canyon at the low water elevation is 175 ft. (53 m.), and the width at the top 185 ft. (56 m.). The Northern Pacific Railroad track above the dam site and the tailwater from the Rock Island project would limit the height of dam to about 77 ft. (23 m.) above low water. This head without storage will develop 38,000 primary horsepower. With 30 ft. (9 m.) of storage on Flathead Lake, the primary power developed would be 92,000 hp.

There is a site on the Clark's Fork above the mouth of the Flathead known as the Fish Creek site. It is about 45 miles (72 km.) below Missoula and the nearest large power site to the town. A head of 108 ft. (33 m.) can be developed by a dam which will give a capacity of 24,000 primary horsepower. The stream at the site for the dam is 150 ft. (45 m.) wide and 6 ft. (1.8 m.) deep. The dam will be about 550 ft. (167 m.) long on top.

There are two power sites on the Kootenai River in Montana. The upper one is at Kootenai Falls on the Great Northern Railroad between Libby and Troy. It will consist of a dam above the falls and a power house at the north end of the dam. There appears to be a very good rock foundation. The head developed will be 89 ft. (27 m.). The primary capacity will be about 20,000 hp.

The lower site on the Kootenai is in Montana near the Idaho line. The canyon is 350 ft. (110 m.) wide at an elevation 50 ft. (15 m.) above low water with good rock abutments and apparently good rock foundation. A 50-ft. head would develop 11,000 hp. of primary power.

USES FOR POWER IN THE STATE

If the railroads are excepted, there is very little steam power generated in the state. All the large mining and manufacturing centers are supplied with electrical power, as are nearly all of the flour mills, grain elevators, creameries, etc. When the Montana industries were going in full stride there was a demand for almost the entire supply of developed power. This means that new sites will be developed for any further railroad electrification or for any large industrial project that may be undertaken.

The total extent of railroad lines in the state is about 4,900 miles (7,885 km.), and of this about 400 miles (643 km.) is electrified. The average requirement for the 440 miles (708 km.) of the Chicago, Milwaukee & St. Paul from Harlowton, Mont., to Avery, Idaho, is 20,000 hp. and the maximum 40,000 hp. The maximum requirement is about 91 hp. per mile. The train miles and the grades on this railroad may not be a fair average for the railroads of the state, but in order to estimate roughly the maximum demand likely to occur for railroad purposes, it has been used and gives a total demand of about 450,000 hp. Since this power may ultimately be furnished on a 50 per cent load factor, a primary capacity of 225,000 hp. where the storage is ample, as in the case of the Big Horn and Flathead Lake projects, would be required.

The total length of the main lines of the Great Northern and Northern Pacific railroads in Montana, counting both the Helena and Butte routes as main lines, and of the part of the main line in Montana of the Chicago, Milwaukee & St. Paul which is not electrified is very close to 2,000 miles (3,218 km.). At 91 hp. of installation per mile, it would require an installation of 182,000 hp. to electrify these 2,000 miles. With a 50 per cent load factor and with adequate storage, the primary capacity required would be only 91,000 hp. according to estimates.

However, it seems likely that the power for this electrification can best be supplied from a large power system having a higher load factor than 50 per cent, thus getting a more continuous use of the installation. The present load factor of the system of the Montana Power Company which supplies power for the Chicago, Milwaukee & St. Paul electrification is considerably higher, or about 87 per cent.

Monel Metal Has Definite Magnetic Properties

Investigation Shows Magnetic Characteristics Considerably Less Than Iron—Important Property in Loss of Magnetism at Temperature Near 200 Deg. Fahr.

BY CHARLES W. BURROWS
Magnetic Research Engineer, New York City

DURING recent years an important alloy of nickel and copper, under the name of monel metal, has been developed and has become quite widely used in the industries. This metal has definite magnetic characteristics which are well below those of soft iron, but the critical temperature at which it becomes non-magnetic is very low, near the boiling point of water—a property which should make it of importance for such use as in relays for temperature control equipment. The metal resists corrosion, moreover, and is tough, strong and elastic.

Because of its growing importance in the arts and industry and, furthermore, because of the complete lack of information concerning its magnetic characteristics, it seemed worth while to investigate the magnetic nature of monel metal not only in the cast condition but also as modified by thermal and mechanical treatment. The monel metal used in this investigation was supplied by the International Nickel Company through the courtesy of Dr. Paul Merica. This material is taken from the standard products regularly supplied commercially, and analyses of the samples tested are given in Table I. The samples of monel metal were examined magnetically by placing them in the uniform field of a long magnetizing solenoid and suddenly withdrawing them from this magnetic field. The resulting change in magnetic flux threading the small detector coil which at the beginning surrounded the metal portion of the test bar is indicated by the ballistic deflection of a suitable galvanometer. This quantity added to the strength of the magnetic field as determined by a separate measurement gives the true induction in the specimen.

FIG. 1 — ELECTROMAGNET USED IN QUALITATIVE MAGNET TESTS

TABLE I—ANALYSES OF THE VARIOUS SAMPLES OF MONEL METAL USED IN THIS INVESTIGATION

			Percentage						
Analysis	Process	Shape	Ni	Cu	Fe	Mn	C	Si	S
P	Hot-rolled	Rod	66.12	28.75	2.68	1.91	0.22	0.29	0.021
Q	Hot-rolled	Sheet	67.12	30.73	1.67	0.22	0.13	0.10	0.026
R	Hot-rolled	Sheet	68.98	29.10	1.60	0.11	0.07	0.10	0.022
S	Hot-rolled	Rod	66.92	29.10	1.70	1.86	0.22	0.17	0.022
T	Cast	Rod	66.18	28.42	2.37	2.10	0.18	0.70	0.038
U*	Cast	Rod	64.50	30.12	2.76	0.87	0.14	0.90	0.062
								*Pb	0.59

Full induction curves for a number of typical samples are shown in Fig. 2, while Fig. 3 has been prepared in order to show the relative magnetic characteristics of monel metal and the usual magnetic materials.

Monel metal, in common with all other magnetic

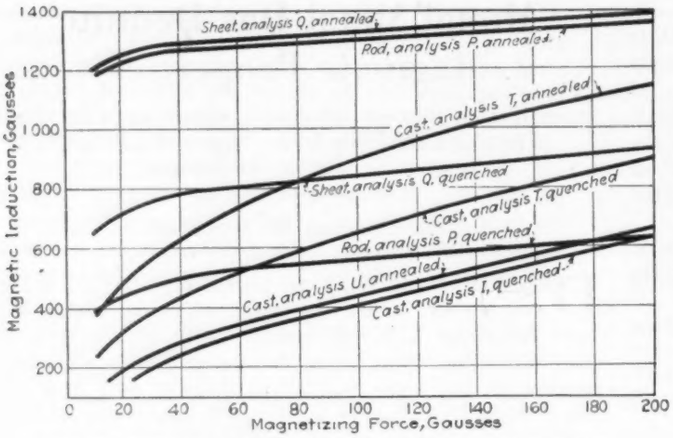


FIG. 2—TYPICAL MAGNETIC DATA FOR VARIOUS CONDITIONS OF MONEL METAL

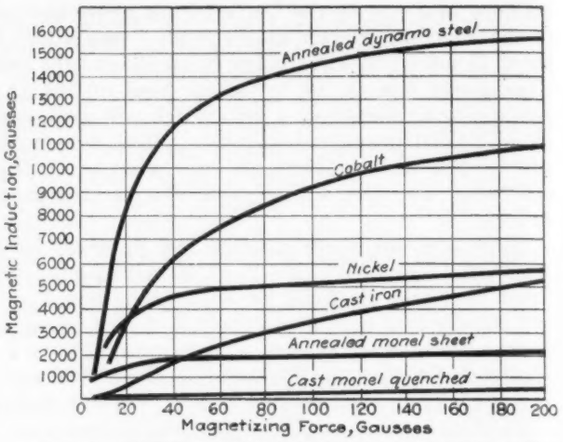


FIG. 3—MAGNETIC CHARACTERISTICS OF MONEL METAL COMPARED WITH OTHER MATERIALS

materials, has a critical temperature below which the material is magnetic and above which it is non-magnetic. This temperature is found by causing the material to pass through a series of ascending and descending temperatures, ending at the temperature at which the magnetic nature changes. In this investigation the critical point was determined by two methods. The preferred method consisted in placing a small slug of the material under test in a beaker of paraffin, at a temperature differing only slightly from the temperature of the paraffin, to pass through the critical temperature. During this operation the slug was repeatedly tested with a small pointed electromagnet and the temperature at which the magnetic change occurs was noted. In the samples tested there was no appreciable difference between the temperature at which the magnetizability of the material disappeared on heating and that at which it reappeared on cooling. The average critical point for a number of sheet and rod samples, hot and cold-rolled, was 203 deg. F. (95 deg. C.).

The other magnetic metals lose their magnetism at considerably higher temperatures. While variations exist between the observations of different persons, the following figures are given as the magnetic critical temperatures of the three common magnetic materials: Nickel, 670 deg. Fahr. (350 deg. C.); iron, 1,440 deg. Fahr. (780 deg. C.); cobalt, 2,000 deg. Fahr. (1,090 deg. C.).

Experiment showed that the heat treatment which will produce the lowest permeability in monel metal consists in heating to a temperature of 1,300 deg. Fahr. (700 deg. C.), cooling slowly down to 350 deg. Fahr. (180 deg. C.), and finally quenching in brine at 16 deg.

TABLE II—CHANGES IN PERMEABILITY PRODUCED BY COLD-WORKING

Magnetizing Force	Change in Permeability
1	100 per cent increase
2.5	17 per cent decrease
5	27 per cent decrease
10	29 per cent decrease
25	28 per cent decrease
50	28 per cent decrease
100	14 per cent decrease
200	12 per cent decrease

Fahr. (—9 deg. C.). The highest permeability resulted from furnace annealing at approximately 1,300 deg. Fahr.

The influence of hot-working upon the magnetic properties of monel metal is shown by a comparison of the magnetic results for the cast material with these results for the hot-rolled material. The cast material in the annealing state shows the lowest induction, the annealing hot-rolled sheet shows the highest permeability, and the hot-rolled rods occur at an intermediate position. In general, the effect of hot-working is to increase the magnetic softness of the monel metal, the cast metal being the hardest magnetically and the sheet which has received the maximum of hot-working the softest magnetically.

Cold-working produces changes in the magnetic characteristics of monel metal. For large magnetizing forces the magnetic changes are similar both in nature and in magnitude to the corresponding changes in the magnetic properties of steel. To determine the effect of cold-working, a monel rectangular bar 10 in. (25 cm.) long was hammered while cold until it showed an increase of 2½ per cent. Table II shows the relative change in permeability between the original specimen and the hammered bar.

Most Popular Incandescent Lamps at Present Time

IN THE vacuum-type lamp the 40-watt size is used to the greatest extent, it representing about a quarter of all lamps of this class. The 25-watt is a good second, followed by the 60-watt and 50-watt. A tendency to standardize the last-named size accounts for a very perceptible increase in its use during the last two years. Meanwhile the gas-filled lamps of 75 watts and 100 watts have risen in popularity, while little change is shown in the larger sizes. It now looks as if the two sizes just mentioned would very rapidly drive out the 100-watt and perhaps the 60-watt vacuum lamps. For street-lighting work the vacuum type has virtually disappeared.

In the matter of voltages there is the same tendency toward clustering around a few particular values that appeared in the days of the carbon lamp, though with somewhat less reason. The three voltages most generally used, including three-fourths of the whole number of lamps, are 110, 115 and 120. The use of the last two has grown at the expense of the first within two years.

The lamp committee brought out these facts at the recent N. E. L. A. convention in Chicago.

Public Necessity the Controlling Factor in Homer Case

Priority of Highway Occupation Gives Telephone Company No Greater Rights Except to Protection from Interference When Substantial

THE "Homer inductive interference case," so called, that has been before the Illinois Public Utilities Commission for more than a year past, was the subject of a second supplemental order on June 30, as noted in the ELECTRICAL WORLD for July 9 on page 84, that is of deep interest to the entire industry. The Homer Electric Light & Power Company in 1920 asked for the right to construct a 13,000-volt line along a country road to serve a coal-mining property. The road was already occupied by telephone lines, both local and long-distance. On its being shown that the customer could be served by a line paralleling an adjacent railway, the commission refused the right to construct the line on the highway and the line was accordingly constructed along the railway right-of-way. In the summer of 1920 a number of farmers along the highway petitioned for service and the commission, after hearing the evidence, granted the authority to construct the line. Approximately 7 miles of circuit are already in use along the highway, and the new line will add about 5 miles to the parallel. The present order is the result of a rehearing on request of the telephone companies. The findings affecting the use of the highway are of extreme importance. The order is presented below in an abbreviated form that includes the most important portions, the citations and discussion of the evidence being omitted:

TWO MAIN ISSUES

The main issues in this case are twofold: First—Whether or not a telephone company occupying one side of a highway with its poles and lines can, by reason of its prior occupancy, stand in the way of an electric company which desires to occupy the opposite side of the roadway for the purpose of furnishing a service to the abutting property owners and local consumers different from that which the telephone company is able to provide; or, in other words, does any legal rule of priority of occupancy of a highway as opposed to a junior company extend to a right in the senior company to limit or prevent property owners along the highway, on their petition therefor, from obtaining and enjoying other and different kinds of public utility service which will reasonably serve their convenience and necessity? Second—(a) Whether or not there is substantial interference with commercial telephone service by reason of the existing parallel, and (b) whether or not substantial interference will result from the proposed extension of the existing parallel. . . .

Counsel for the petitioning farmers in his argument contends that farmers and local communities are not users of extreme long-distance telephone service and that service of this character, if of such nature as to be unable to operate in the vicinity of other public utilities, should seek the seclusion of a private right-of-way rather than a public highway. . . .

HIGHWAY PRIORITY

It must also be remembered that the present inter-city and transcontinental use of highways for automobile highway traffic and for long-distance service of any kind is entirely modern; that these highways still retain as fundamental the original idea of a local road; that each such highway furnishes to persons living thereon their sole line of public communication, of ingress and egress to and from their premises, and that for the regulation and protection of the rights of the abutting property owners as to additional burdens on the highway and the right of unobstructed ingress and egress to their property, as well as the preservation intact of the public easement of the right of travel on all the highway, certain well-defined rules have been adopted by our courts and maintained for many years. . . .

The commission in a case of this kind will take into consideration the fact that the abutting property owners along a highway have dedicated the highway to the public use, retaining in themselves the fee of the highway. . . . In cases of this kind the commission is governed largely by the convenience and requirements of the abutting owners.

It is the policy of this state to foster the development of its rural communities, and this commission believes that a public utility which happens to be the earlier occupant of a highway must recognize the fact that the prosperity and growth of the community require the further use of the highways by other utilities, and therefore that all such utilities, both earlier and later occupants of the highways, must so operate and construct their own lines as to prevent unreasonable interference one with the other. . . .

EQUAL HIGHWAY RIGHTS

The law is clear that public utility companies exercising similar franchises, such as companies operating transmission, telephone and telegraph lines, have equal rights in the highways and that priority of occupancy by one company does not give to that company the right to exclude other such companies from occupying the highway. Prior occupancy may perhaps give the prior occupant a right superior in some respects to that of a later comer. This superior right, however, is limited to protection from interference substantial in character. . . .

SUBSTANTIAL INTERFERENCE

We come now to the second proposition presented to this commission for its decision, (a) whether there is substantial interference with commercial telephone service by reason of the existing parallel. This is largely a question of fact. The telephone companies introduced in evidence the results of tests made with a "noise meter," the results of tests made to determine the "telephone interference factor" and the testimony of telephone experts and of two telephone operators. . . .

In this case tests were made on twelve circuits, on nine of which the noise was not in excess of 800 units. The other three circuits on which the noise was found to be severe are phantom circuits. The testimony indicates that reasonably satisfactory service can be rendered over telephone circuits on which the noise units are not in excess of what was found on nine of these circuits. The telephone lines in the section tested are transposed in a standard manner for the elimination of cross talk and mutual unbalances, but have not been transposed since the electric supply line was constructed. . . .

DISADVANTAGES OF LISTENING TESTS

In the development of the telephone industry it has been found that for testing purposes the ear is a relatively crude instrument compared with highly sensitive electrical instruments. Listening tests have the disadvantage that they depend upon the judgment of the listener and upon the condition of the receiving station, and tests on telephone lines to determine interference are possibly not representative, in that the conversations may have been routed over the best or worst circuits. The commission recognizes and appreciates the value of instrument tests in the development of the telephone industry where a comparison of telephonic transmission under various conditions is primarily sought. . . . A determination of whether interference is substantial and whether the service may be considered reasonably commercial may be better determined by conversational tests made at a time when the instruments are generally used and during periods when the conditions affecting both electric and telephone lines are representative and when normal conditions of attenuation and accumulation prevail. . . .

The telephone companies' experts claimed that a telephone interference factor having a value of 173 is unduly

high. The record shows, however, that at the present time only meager data are at hand with reference to the importance of telephone interference factor tests. It was admitted by practically all the expert witnesses for both sides that the telephone interference factor is but one of a large number of factors influencing the disturbance in the paralleling telephone circuits. Other factors are voltage of the electric supply line, separation of the conflicting lines, inequality of the capacity of the conductors to ground, residual voltages and current, unbalance of the power circuit, character of harmonics in the inducing circuit, character of the transpositions in the supply and the signal lines, the degree to which they are co-ordinated and the distance of the telephone subscriber from the section paralleled. Extensive reference was made to a paper written by H. S. Osborne, entitled "Review of Work of Sub-Committee of Wave-Shape Standard of the Standards Committee," presented at a meeting of the American Institute of Electrical Engineers on Feb. 20, 1919, a copy of which paper was introduced in evidence. The writer himself does not appear to have given to this factor the importance that was attached to it by the telephone companies' experts in this proceeding. . . .

MUST SHOW REAL HANDICAP TO CONVERSATION

This commission will not hold the interference to be substantial unless it is conclusively shown that service is impaired to the extent that the user of the telephone is clearly handicapped in his conversation, or is readily aware of the induction without making a point to listen for the disturbance, or that an unusual amount of repetition is necessary, or that the words of the speaker are made unintelligible. It is not sufficient to prove that noise can be detected by the use of delicate instruments, or that a slight hum can be heard by the tester when a special effort is made to notice it. Neither is it sufficient to state that the telephone service on a particular line may sometimes cause the transmission of unsatisfactory messages. Even on the best telephone circuits service is sometimes unsatisfactory without any pronounced cause. . . .

We now come to the second part of the second proposition, (b). The witnesses for the telephone companies claimed that the construction and operation of the additional proposed parallel from Fairmount to Catlin will result in such inductive interference as to render the telephone lines uncommercial. They base their conclusions upon the alleged interference arising from the existing parallel and upon the theory that interference caused by the proposed parallel by reason of accumulation would be substantial. It is evident that the testimony of these witnesses was largely conjectural. . . . The record shows that good telephone service is being rendered in the cases of many parallels throughout the country where the parallels are longer and where factors tending to induce serious interference are greater than in the present case. Where, as in this case, a parallel is unavoidable, there are shown standard methods in common use for the elimination or substantial reduction of such interference as may exist.

The telephone companies contended that the proper method of furnishing electric light and power service to the petitioning prospective consumers along this highway is by means of a low-voltage distribution line. The application of this method would necessitate in this case the continuance of the existing 13,000-volt line of the power company along the Wabash Railroad, paralleling the highway in question. This would mean a duplication of investment, additional cost of operation and maintenance and a likelihood of impaired electric service. . . .

FRANCHISES ALWAYS SUBJECT TO RIGHTS OF OWNER

It is plain that in case of new construction by two utilities on a highway each utility would bear the cost of making the necessary transpositions in its own lines and of installing that character and standard of construction that would render good commercial service. When a public utility obtains a right or franchise to operate upon the highways of the state it takes such right or franchise subject to the rights of the owner of the underlying fee to the public easement of right of travel and to the right of the state to permit the occupancy of such highways for other public purposes.

The record in the instant cause indicates that there may be certain readjustments of the power and telephone lines to permit of the rendition of good commercial telephone service. The record, however, does not indicate the extent of these necessary readjustments or transpositions nor the probable cost to the parties hereto of making such transpositions. The commission, therefore, is not at this time expressing an opinion as to the proper allocation of costs of necessary changes, but in the event that the power and telephone companies cannot come to a satisfactory settlement the commission will take evidence as to the cost of the necessary remedial measures and the proper allocation of the cost thereof between the parties hereto. . . .

COMMISSION'S FINDING

The commission, having considered all the pleadings herein and all the evidence adduced and the representations and arguments presented, and being fully advised in the premises, finds:

1. That the construction and operation of the proposed additional 5 or 6-mile parallel from Fairmount to Catlin, along the highway commonly known as the "hard road," but on the opposite side thereof from the telephone lines, will not in any substantial degree interfere with the rendering of good commercial telephone service, provided that (a) the existing 13,000-volt, single-phase electric transmission lines are changed to three-phase as specified in the findings hereinafter, (b) the electric transmission line is transposed to co-ordinate with transpositions in the paralleling telephone circuits, (c) the telephone circuits are properly transposed.

2. That a large number of farmers residing along said highway between Fairmount and Catlin have petitioned for, and are entitled to, electric light and power service, and that the most feasible and practical method of furnishing this service is by extending along the highway from Fairmount to Catlin a 13,000-volt transmission line.

PROSPERITY REQUIRES ELECTRIC SERVICE

3. That the growth and prosperity of the farming communities of this state require that such communities be supplied with electric light and power service, as well as with telephone service, and that the future development of rural communities will be seriously impeded if one class of utilities, such as telephone companies, be given a monopoly of the highways to the exclusion of other utilities subsequently seeking to come upon the highway to fulfill an equally important service.

4. That the public would be best served by the construction and operation of a 13,000-volt, three-phase transmission line along the hard road between Fairmount and Catlin and that the public convenience and necessity require the construction and operation by the Homer Electric Light & Power Company of such a line along the said road, such line to be located upon the opposite side of the highway from that at present occupied by the telephone circuits of the Illinois Bell Telephone Company, the American Telephone & Telegraph Company and the Vermilion County Telephone Company.

MUST MAKE LINES THREE PHASE

5. That the existing single-phase transmission lines of the Homer Electric Light & Power Company extending from Homer to Fairmount and from Fairmount to Jamaica should be made three-phase by said company and properly transposed to co-ordinate with transpositions in the paralleling telephone circuits, and that the proposed electric line between Fairmount and Catlin authorized herein should be transposed to co-ordinate with proposed transpositions in the telephone circuits.

6. That the evidence fully sustains the opinion and order of this commission entered Sept. 28, 1920, and that the said opinion and order should be affirmed except in so far as modified by the terms and conditions that are hereinafter specified.

Interconnection Affords Great Benefits in Italy

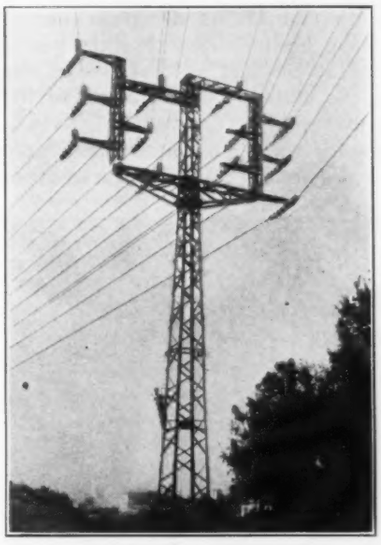
Difference in Seasonal Flow in Mountain Ranges Makes Interconnection Essential—Ornate Architecture of Italian Plants

CO-ORDINATION of water resources for efficient power production was emphasized as a striking feature of hydro-electric development in Italy by Guido Semenza of the Italian electrical mission to the United States at the recent N. E. L. A. convention in Chicago. He pointed out that about 6,000,000 kw. in water power is available in Italy, which has an area of about 111,000 square miles (287,000 sq.km.), or twice the surface of Illinois. There are two main hydro-electric systems, one in the Alps and the other in the Apennines. The former yields a maximum flow of water in summer and the latter in winter. Through interconnection and the construction of storage reservoirs these non-synchronous flows are utilized to the maximum extent, some steam auxiliary plants being installed for supplementary service. The Milan-Lombardi region is served effectively through the use of a storage reservoir of very large capacity supplying water under a head of 900 m. Interchange of energy between the Alps and Apennine plants was brought about by the necessities of the war, and various important interconnections are still incomplete in minor detail.

Generally two companies which desire to interchange energy divide the expense of the line, or otherwise they form a separate company to build the line.

Up to the present time, Mr. Semenza said, about 1,200,000 kw. has been developed which could be used all the year around for about fifteen hours per day. Recently there have been constructed many new plants having an aggregate capacity of 550,000 kw., and franchises have already been granted for about 2,000,000 kw. of new power to be developed.

It is considered essential that the architectural style of buildings in Italy be kept up even if they are for hydro-electric purposes, said Mr. Semenza. Formerly, when a castle, a bridge or anything in the nature of a public building was erected artists were called in to design it, and for this reason Italy is full of beautiful structures designed and erected in past generations. It is considered advisable to continue this practice since the cost of doing so does not increase the total expense of the plants more than 1 per cent compared with what it would cost to erect them in a plain style. An interesting plant at Vivarone was described. This plant belongs to the Società Idroelettrica Piemonte ed Elettricità Alta Italia. Here is a case of artificial storage of power. The company had a certain amount of power available during the night which it wanted to store for use during the day. A place was found where there were two lakes with a difference in elevation of 483 ft. (147 m.). On a level with the lower one, Lake Vivarone, a plant was erected and equipped with a set of motor-driven high-pressure pumps which could be used during the night to pump the water from the lower lake to the higher lake. During the day the water thus stored was discharged into the lower lake through waterwheels driving generators. From the technical point of view it



NARROW-BASE TOWERS ARE BEING USED IN ITALY EVEN AT ANGLES FOR ECONOMY

WATER IS PUMPED TO UPPER LAKE AT NIGHT FOR USE DURING THE DAY—NOT ONLY THE DESIGN OF POWER PLANTS BUT THEIR SURROUNDINGS ARE ARTISTIC

worked well, but the efficiency of the whole system is very low. The calculated efficiency is 53 per cent, but the real efficiency is not more than 40 per cent.

In Italy electric service companies have the right of eminent domain. Transmission lines can be erected over the straightest and shortest course, arrangements being made for fixing the price of the land so utilized and of all litigations that may arise therefrom. This law is said to work very satisfactorily and has facilitated enormously the distribution of electrical energy.

All the franchises have been limited to sixty years, with the provision that at the end of that period the plant will go back to the state. This would give the impression that state ownership will eventually result, but Mr. Semenza expressed the hope that in the course of the next fifty years people will have recovered from

IN ITALY ARTISTIC ARCHITECTURE IS APPLIED TO HYDRO-ELECTRIC PLANTS AS WELL AS ALL PUBLIC BUILDINGS

their present notions about state or government ownership of such plants. Load factor was recognized by Mr. Semenza as being very important, but he said it is not such a vital factor when water can be stored. However, an effort is being made to urge the use of energy at a very good load factor by the introduction of electrically equipped kitchens with arrangements for accumulation of heat. Such a kitchen would demand only 1 kw., but over a period of twenty-four hours, and would be available at any time for cooking. Electrical energy is also used to a very considerable extent for heating water for domestic uses, continuous heater being employed. To encourage this application special rates are being offered.

In Italy the rates are tending toward the plain kilowatt rate. While there have been efforts to introduce special forms which take power factor into consideration, these systems are rather complicated and not accepted with great enthusiasm by customers of central stations. In France the tendency appears to be in that direction, but it is not considered worth while in Italy.

There are some flat rates for distributing energy to workmen's houses where there are perhaps only two or three lamps, but these rates are being discontinued. Some utilities are using the maximum-demand system, and in Mr. Semenza's opinion this system may be very useful if properly applied. That is, the energy consumed should be charged for in kilowatt-hours and the maximum demand in kilovolt-amperes. This would take care of the power-factor question.

Readers' Views and Comments

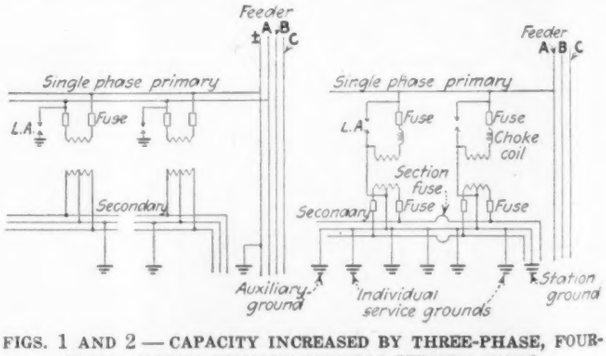
This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Copper Economies in Primary Distribution

To the Editor of the ELECTRICAL WORLD:

SIR: In primary distribution the three-phase system is now so generally used that it may be considered standard. However, the majority of companies still stick to the older delta 2,300-volt connection in spite of the fact that by changing to star connection they can still use identically the same apparatus and increase the capacity three times for the same power loss. All that is necessary is a neutral conductor; but, like the secondary neutral this must be thoroughly grounded to avoid serious difficulty due to the shifting of this neutral placing undue voltage strains on equipment. Grounding the neutral at the station only will not work under abnormal operating conditions unless the neutral is very short and of large cross-section. To hold the system successfully to constant potential to earth requires a number of solid high-current-capacity grounds scattered over its length. It is also very important to see that at least one ground is installed near the end of every neutral branch in order that in no case a break in this conductor shall permit it to float and raise the potential on the apparatus connected beyond the break. Where this point receives careful attention the 2,300/4,000-volt star primary system is far more reliable than the delta system and much less costly.

In most systems the power requirements are more or less concentrated, following railroad arteries where trackage is available. The larger portion of the area served is residential in character and can well be served from single-phase sections taken from the main three-phase feeder lines. Where this method is used there is



FIGS. 1 AND 2 — CAPACITY INCREASED BY THREE-PHASE, FOUR-WIRE SYSTEM; COMMON NEUTRAL PERMITS ELIMINATION OF ONE WIRE

of course no difference in cost between the delta and the star primary system except that less attention need be given to the insulation and protective equipment on the side that connects to the grounded neutral.

At this time, when more than ever close attention must be given to economies in order to offset increased material costs and interest rates, most careful considera-

tion should be given to what is termed the "common neutral system" by the few companies whose engineers have had the courage and initiative to take advantage of its economical features.

Briefly, this system is based on the very simple fact that if the secondary neutral is permanently and effectively grounded to protect against high-tension crosses of an accidental nature, it can just as well operate safely with a permanent high-tension cross. With the secondary neutral grounded and interconnected there is a grounded conductor parallel to the second grounded conductor used as the primary neutral of the 2,300/4,000-volt four-wire primary system. If these are each properly grounded, as they must be, they in effect become the same wire in so far as potential to earth is concerned. The common neutral system simply combines these two wires physically as they already are combined electrically. An idea of what this means from an economic standpoint can be seen when one considers that the feeder wire required is reduced by one wire out of the four, or 25 per cent. On single-phase distribution it permits of the removal of one of the two wires, as well as the protective equipment on one side of each transformer, or a clear saving of 50 per cent. In addition, the voltage drop over this large aggregate cross-section neutral grid is so low as to be virtually negligible, so that the power loss on the single phase is just about cut in half.

This seems almost like keeping our cake and eating it also, but actual operating experience has proved that all this can be done and more. The system has been operating for about eleven years in the largest city in Canada with a record of not a single accident due to the combining of these two neutrals. Three years' operation in one of our larger Middle Western cities has repeated this absolutely successful experience. Based upon this experience, it can be safely stated that the central stations of today have invested millions and millions of dollars in unnecessary copper erected by engineers who prefer to stick to the beaten path rather than try something just a little different from that in ordinary use.

S. B. HOOD,
Superintendent of Distribution.
Northern States Power Company,
Minneapolis, Minn.

Contact with 33,000-Volt Circuit Did Not Kill Man

To the Editor of the ELECTRICAL WORLD:

SIR: Recently, while examining some high-line oil switches preliminary to overhauling them, Charles Moore, foreman of high-line department of the Texas Light & Power Company, came into contact with a circuit and established a ground through his body. While he was so badly burned that he lost his right hand, he never lost consciousness, despite the fact that the circuit was operating at 33,000 volts. Mr. Moore and an assistant had been standing before the switch box the door of which was off. Mr. Moore, it is thought, swung around to leave and as he did so he caused an arc and was knocked down. The assistant threw himself upon the ground and was unhurt. Witnesses of the accident rushed to the stricken man, expecting to find him dead, but to their amazement he began to talk to them and intelligently directed the first-aid work himself.

The discharge entered his right hand, traveled through his body and passed through his left leg. The concrete flooring on which Mr. Moore was standing at the time clearly showed the outline of Mr. Moore's left foot, having been turned black where current passed out of his body. It is estimated that the minimum voltage which he could have received was 19,000 volts.

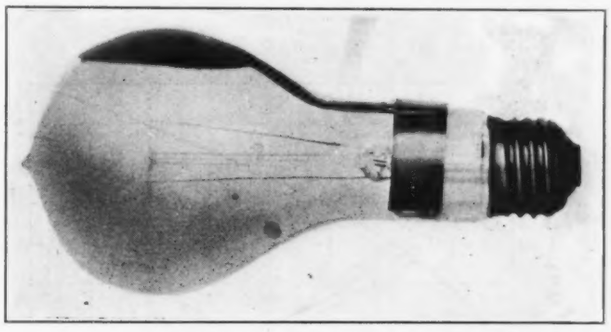
Dallas, Tex. W. P. MACKLE.

Change and Development in Sign Lighting

To the Editor of the ELECTRICAL WORLD:

SIR: Users of electric signs have shown such a decided tendency toward higher wattage and increased brilliancy of lamps that it seems advisable to call attention to the new developments and suggest remedies for the troubles that have to be met.

Most important of the new developments in lamps for this service are the 25-watt and 50-watt blue glass type B sign lamps. If they are used to replace 10-watt lamps, it is necessary to find out whether both feeders and circuits are of sufficiently heavy wire to carry the increased load and comply with the fire underwriters' rules. If the wires are much too small, the lamps will burn at a low efficiency and will lose the brilliancy that the change was made to gain.



SHIELD FOR GAS-FILLED LAMPS WHEN USED EXPOSED TO WEATHER IN HORIZONTAL POSITION

Although the glass used in these sign lamps is the same as that used for the daylight type C lamps, the blue sign lamps should not be used for color matching because even approximate daylight will not be produced with this glass except when used on a lamp having considerably higher filament temperature than a vacuum lamp.

The blue B sign lamps are able to withstand all sorts of weather conditions without protection of any kind. The color is permanent, and since the bulbs do not become so hot as those of gas-filled lamps they are not cracked by cold rain. The filaments are coiled in a ring shape and mounted on a short stem. This construction makes a strong lamp and gives high end-on candle power.

Although a great many type C lamps are now used for sign lighting, they were not originally designed for that purpose, and manufacturers do not feel that they can recommend them for it without adequate protection. The metal caps here illustrated for covering the hot spot on the bulb are a great help. This hot spot is directly above the filament when the lamp is burned in a horizontal position, and if not protected the glass is apt to crack when struck by rain or snow.

Some 50-watt white-bulb tungsten-filament lamps have been used to advantage where the chief requirements for the sign are that it should be particularly clear, easily read and free from glare. However, the favorite at the present time is without doubt the 75-watt daylight type C lamp.

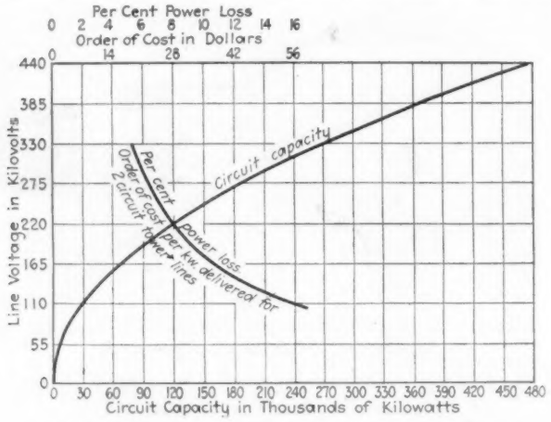
EDWARD B. FOX.
Harrison, N. J.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Economic Study of Transmission at 220,000 Volts

THE economics of transmission at very high voltages are summarized in the accompanying curves, which were shown by J. P. Jollyman at a recent meeting of the San Francisco Section of the American Institute of Electrical Engineers. This figure shows the most



CHARACTERISTICS OF 200-MILE 60-CYCLE CIRCUITS

important characteristics of 200-mile 60-cycle circuits from an economic standpoint.

The maximum capacity of an alternating-current circuit is largely determined by the voltage consumed by the impedance of the circuit. Assuming that the impedance voltage of a circuit is fixed as a certain percentage of the volts delivered, the maximum capacities of 200-mile 60-cycle circuits are found to be proportional to the squares of the circuit voltage. A 55-kv. circuit would deliver 7,500 kw., a 110-kv. circuit 30,000 kw., a 220-kv. circuit 120,000 kw., and a 440-kv. circuit 480,000 kw. Having established the carrying capacities of circuits of different voltage, and having a certain amount of power such as 240,000 kw. to transmit, the next problem is to determine which voltage will be the least expensive to employ. The cost of transmission includes the fixed and operating charges and the value of the lost power. In comparing the efficiency and cost of circuits of different voltages the most economical size of copper for each voltage is determined by an application of Kelvin's law. It will be seen that while the capacity of a 220-kv. circuit is four times as great as that of a 110-kv. circuit, the losses are only half as great and the cost only half as great in the case of two-circuit tower lines. It is apparent that 220 kv. is the more economical voltage to employ in this case.

It might be argued that a higher voltage than 220 kv. would give a still more economical solution, if in fact such a voltage were possible with apparatus now available. However, 330-kv. or 440-kv. circuits have capacities so large in comparison with the developments proposed today that their use does not seem to be warranted even if the possibility of their operation were proved. Another fact to consider in this connection is that the charging kva. is proportional to the square of the voltage and is about one-third the circuit capacity. To operate successfully requires generating units of a size to charge one circuit with one unit. To change the 220-kv. circuit will require a generator of about 40,000-kva. capacity, a 330-kv. circuit would require a 90,000-kva. generator, and a 440-kv. circuit a 160,000-kva. generator. The latter sizes are far beyond anything thus far attempted and exceed the total power to be had from any except a very few developments. With properly distributed synchronous condensers it is believed that 220-kv. transmission can deliver over distances of 400 or even 600 miles with good efficiency and at an expense not prohibitive.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

New Design for 15,000-Volt Bus Support

DUST DOES NOT COLLECT ON THE PORCELAIN

A NEW heavy-duty 15,000-volt bus support will be used in the new station of the Hartford Electric Light Company. The design is unusual in that the porcelain has no corrugations and is finished with a white glaze, giving a surface which will not collect dirt readily and will also make it conspicuous. The porcelain with top and bottom fittings can be used interchangeably to take two-bolt or four-bolt bases and any size of bar or cable clamp. The general appearance of the unit is shown in the accompanying cut and the principal dimensions follow:

Height to center of clamp, in.	7¾
Center to center of base bolts, in.	5½
Height of porcelain, in.	3½
Maximum diameter of porcelain	6¼

Units are required to pass these tests:

Porcelain before assembly, volts	60,000
Assembled units, volts	45,000
Tensile strength of assembled unit in line with the vertical axis, lb.	2,500
Cantilever strength applied at the cable or bar clamp at right angles to the vertical axis, lb.	2,000

The test results show an ample margin of safety.

Stone and Webster, Inc., R. E. ARGERSINGER.
Boston, Mass.

Estimated Cost of Hydro-Electric and Transmission Construction

AN ESTIMATE of the cost of building a new hydro-electric plant of 6,000-hp. rating and 66,000-volt lines from this station to other points on its system has been prepared by the New England Power Company.

The estimate is for doing this work during 1921 and 1922. It is based upon the company's extensive experience in hydro-electric plant and line construction in central New England and assumes wooden-pole lines and a generating station operating under a head of about 245 ft. and producing about 25,000,000 kw.-hr. per year. The proposed dam, to be built south of the present Somerset Reservoir, is to be from 30 ft. to 40 ft. high.

The data were compiled in connection with an application which was made recently to the Massachusetts Department of Public Utilities for authority to issue securities.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

COST OF 6,000-HP., 6,600-VOLT HYDRO-ELECTRIC PLANT, OPERATING UNDER 245-FT. HEAD

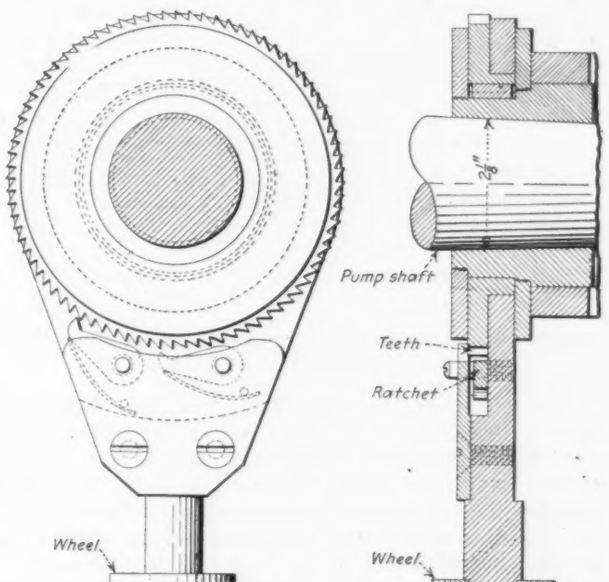
1. Preliminary and General:		
Clearing	$6,000	
Highway changes	4,000	
Construction roads	14,000	
Additional lands	12,000	
		$36,0000
2. Dam:		
Stripping dam site 4,000 cu.yd., at $1.10	4,000	
Dam embankment 60,000 cu.yd., at $1.10	66,000	
		70,000
3. Spillway:		
Excavation, 1,500 cu.yd., at $2	3,000	
Concrete, 2,800 cu.yd., at $25	70,000	
		73,000
4. Outlet:		
Racks, gates and housing	8,000	8,000
5. Conduit:		
Excavation, 50,000 cu.yd., at $2	100,000	
8-in. wood-stave pipe, 21,000 lin.ft., at $21	441,000	
River crossing	20,000	
Trestles, 1,000 lin.ft., at $16.50	16,500	
Vents, 600 lin.ft., at $25	15,000	
Brook intakes, two, at $3,000	6,000	
		598,500
6. Surge Tank:		
Excavation, 1,200 cu.yd., at $2.50	3,000	
Concrete, 120 cu.yd., at $25	3,000	
Steel, 70,000 lb., at 10 cents	7,000	
		13,000
7. Penstock:		
Excavation, 1,000 cu.yd., at $3	3,000	
Concrete cradles, 80 cu.yd., at $25	2,000	
Steel, 235,000 lb., at 9 cents	21,200	
		26,200
8. Power-Station Building:		
Substructure, 4,500 kw., at $4	18,000	
Superstructure, 4,500 kw., at $4	18,000	
		36,000
9. Power-Station Equipment:		
Hydraulic equipment, 4,500 kw., at $18	81,000	
Electrical equipment, 4,500 kw., at $31.50	141,000	
		222,000
10. Sub-total		$1,082,700
11. Engineering and supervision (5 per cent)		54,300
Total		$1,137,000

COST OF 66,000-VOLT, SINGLE-CIRCUIT TRANSMISSION LINES

1. Length 6 miles; No. 2/0 copper; thirty poles per mile:		
Clearing 90-ft. right-of-way	$3,490	
Poles, 180, at $15	2,700	
Power wire, 19,800 ft., at 17 cents	3,366	
Insulators and hardware	7,855	
Pole erection	5,860	
Hauling, stringing wire, etc.	3,060	
Telephone wire and materials	1,160	
Installing telephone line	1,095	
Right-of-way	5,244	
Engineering and supervision (5 per cent)	1,691	
Sub-total		$35,521
2. Length 9.5 miles; No. 2/0 copper; fifteen double-pole structures per mile:		
Clearing 125-ft. right-of-way	$8,370	
Poles, 286, at $15	4,290	
Power wire, 62,500 ft., at 17 cents	10,625	
Insulators, cross-arms and sleeves	15,410	
Pole erection	9,640	
Hauling, stringing wire, etc.	4,890	
Telephone wire and materials	3,590	
Installing telephone line	1,400	
Right-of-way	8,356	
Engineering and supervision (5 per cent)	3,329	
Sub-total		$69,900
3. Length 21 miles; No. 2/0 copper; fifteen double-pole structures per mile:		
Clearing 125-ft. right-of-way	$18,150	
Poles, 630, at $15	9,450	
Power wire, 137,800 ft., at 17 cents	23,430	
Insulators, cross-arms and sleeves	32,785	
Pole erection	20,890	
Hauling, stringing wire, etc.	9,805	
Telephone wire and materials	8,615	
Installing telephone wire	2,275	
Right-of-way	30,050	
Engineering and supervision (5 per cent)	7,770	
Sub-total		$163,220
Total		$268,641

Rotary Plungers on Pumps Reduce Maintenance Costs

A VERY great reduction in the cost of maintaining reciprocating plunger pumps has been made by the use of a device for rotating the rods and plungers of such pumps in plants of a Western company. The plungers of outside-packed pumps often wear unevenly and deep grooves are worn on them. When in this condition it is difficult to keep the packing tight enough to prevent leakage, the wear on the packing is very great, and the power consumed for the operation of the pumps is much larger than it should be. By rotation of the pump rods and plungers the wear on them is evenly distributed over the entire rubbing surface. These parts are kept smooth and polished, and as a result the amount of packing used is very greatly decreased. In addition, the amount of power required for driving the pumps is reduced and the life of the plungers is about doubled.



THIS INEXPENSIVE ATTACHMENT DOUBLES THE LIFE OF PUMP PLUNGERS AND RODS

The device used is a ratchet which causes the pump rods and plungers to rotate a fraction of a turn during each stroke of the pump. The lever of the ratchet is actuated by a small wheel which runs on a camway mounted on the frame of the pump beneath the rod.

FIELD EDITOR ELECTRICAL WORLD.

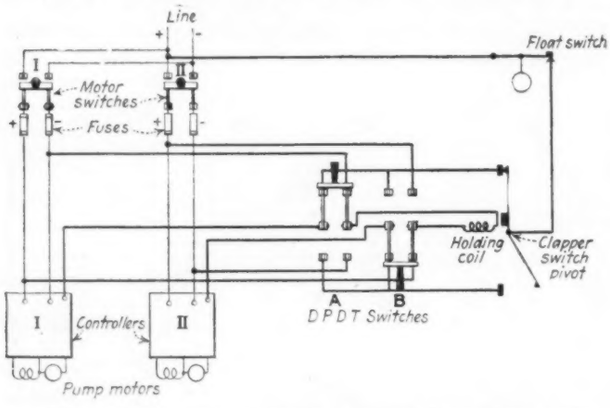
San Francisco, Cal.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

House-Pump Control Which Assures Water Supply

WHERE two motor-driven pumps are used for filling the storage tanks of a large building, an automatic system which will cause the second pump to come into operation in case the fuse blows on the line supplying the first one is very desirable. Such a scheme



WHEN A FUSE ON ONE OF THESE MOTORS BLOWS THE OTHER IS AUTOMATICALLY STARTED

has been developed for installation in a large industrial plant in Brooklyn, N. Y. With this system either pump may be made to carry the load regularly, and on failure of the fuse of the motor driving this pump the other motor will automatically start pumping. Moreover, if desired, the motors can be connected to operate in parallel controlled only by the float switch in the tank.

The scheme of the connections is shown in the accompanying diagram. The heavy lines represent the wiring for the automatic control feature mentioned. There is a supply line feeding two pumps, No. 1 and No. 2. A line taps off the incoming line ahead of the motor switches and passes to the float switch on the roof. Instead of going directly from the float switch to a controller, it passes through the clapper switch and then through other wiring to the controller. In order for the circuit from the clapper switch to the controller to be complete, one of the double-throw switches, *A* or *B*, must be in the upper position. When *A* is in the upper position, the circuit is complete from the clapper switch to the controller for motor No. 1. When *B* is in the upper position, the circuit from the clapper switch is complete to controller No. 2. With this position of the switches both of the motors are connected in parallel and controlled by the float switch. However, if switch *A* is thrown up and switch *B* down, then motor No. 1 normally does the pumping. If either of the fuses on this motor blows, this takes current off of the holding coil, which releases the clapper switch. The clapper switch falls to the downward position, and this throws energy on the control coil in controller No. 2.

For motor No. 2 to operate normally switch *A* is thrown down and switch *B* upward. Then if a fuse blows on No. 2 the holding coil releases the clapper switch, which falls down and puts energy upon controller No. 1

W. A. HARRIS.

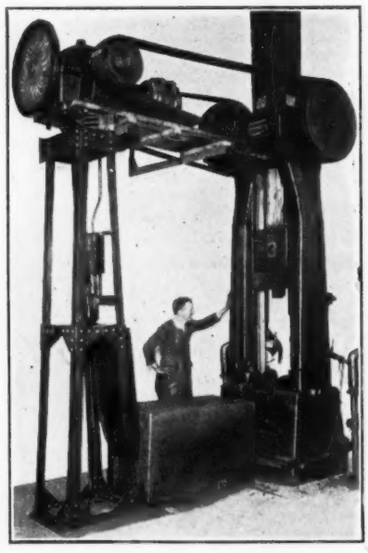
New York, N. Y.

Individual Drive for Drop Hammer Has Advantages

THE application of individual motor drive to machine tools of various sorts has been extended by the General Electric Company to the equipment of several board drop hammers in its Schenectady works. The drive was originally applied, as an experiment, to a 300-lb. hammer and proved so successful that the range has been expanded to include hammers of 600-lb., 1,500-lb. and 2,500-lb. sizes.

The design is the same in all cases, except for variations made necessary by the weight of the hammer. The only basic change since the first ones were installed is the use of induction instead of direct-current motors for the drive. As shown by the illustration, the whole outfit consists of two towers, one composing the hammer mechanism proper and the other serving to support the other end of the platform carrying the motor, gears, etc. The supporting frame is a light structural steel tower, on which are mounted the starting switches for starting the motor.

The operation is very simple.



INDIVIDUAL DRIVE ELIMINATES SHAFTS AND BRACING

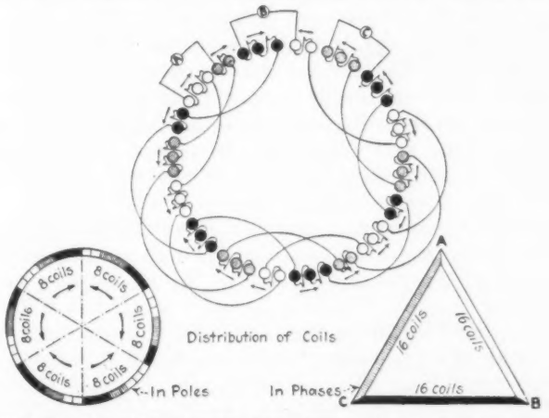
A 15-hp., 800-r.p.m., 40-cycle induction motor is directly coupled to a shaft carrying one loose and one keyed pinion and a flywheel on the extreme end. The flywheel serves to take the initial peak load off the motor when the hammer is drawn up. The keyed pinion engages two beveled gears, which are directly connected to two pulley wheels. The loose pinion simply acts as a spacer on the opposite side of bevel gears. This arrangement of gears causes the two pulleys to revolve in opposite directions, and these are belted to the pulleys on the shafts of the rollers, which when forced together raise the hammer. The gearing is all inclosed and immersed

in oil. The total speed reduction through gears and pulleys is eight to one.

Once the motor is started, it runs continuously, operation of the hammer being obtained through a treadle control which separates the rollers and lets the hammer down. The length of the drop is controlled by an adjustable trigger on the hammer frame which comes in contact with a wooden stud on the hammer. The force of the blow is due entirely to gravity. Repeated blows can be obtained automatically by this arrangement, as long as the treadle is depressed.

Simplified Connections and Diagrams of Three-Phase Motors

A SET of simple and clear diagrams for the reconnection of motors by ordinary machinists who were not familiar with the usual style of connections adopted in motor diagrams was desired by the manager of an important manufacturing establishment of Lima, Peru.



VERY SIMPLE DIAGRAM FOR SHOWING MOTOR CONNECTIONS

The work was started having in mind that the diagrams to be prepared must show clearly and faithfully not only the sequence of groups, poles and phases, but also the formation of groups. Starting at the two terminals of each coil, it was proposed to make a detailed and continuous line representation to converge at the three motor terminals. In some cases it became necessary to alter the usual style of connection so as to make practicable the reconnection in the most simple and regular way. The phases were shown differently, the terminals had to be located symmetrically, the top and bottom splicings were drawn separately, and even the coil-to-coil stubs were clearly indicated. Among the diagrams prepared there were some for twelve, ten, eight, six and four poles, using 2,200, 550, 440 and 220 volts both for American and German makes of motors.

The accompanying drawing is a sample of the diagrams made. It belongs to a 5-hp., 1,150-r.p.m., 220-volt, forty-eight-coil, series-delta, three-phase motor. Each of the small circles represents a coil. The different phases are drawn respectively clear, hatched and black. The lines issuing from the small circles represent the terminals and connection ends of the coils, and there is no other explanation accompanying the diagram than the direction to connect the motor in strict accordance with the lines joining the small circles. As the motor requires odd grouping of coils, the distribution of coils in poles and phases is also indicated.

V. M. ARANA,
Lima, Peru. Consulting Electrical Engineer.

Observations on Armature Dipping and Baking

ALTHOUGH a knowledge of varnish, ovens, methods, insulation, ample shop space and a liberal number of spare armatures will permit the most effective method of handling armature dipping and baking, it will be found in the usual run of practice that deviation from constant temperature, constant specific gravity and duration of baking periods will be found to speed up operations without any apparent disadvantages. It is with this viewpoint in mind that the writer desires to present some observations on armature baking as gained during the treatment of several hundred armatures.

There are many good features in armature baking that represent real advantages and that will make themselves felt in operating results. For instance, fixation of the coils in the slots is important. Through shrinkage of insulation or failure of the band wires to exert direct pressure on the coils, the undipped armature will frequently suffer from abrasion of insulation or breaking or loosening of leads. The treated armature, however, is free from such trouble. The sealing of the seam between the end of the commutator and the string or tape band is also another real advantage.

If the treatment puts a hard glazed surface on this band and a hard glazed fillet in the seam, it is, from the standpoint of operating troubles, well worth while. In order to get the glaze desired and to fill the seam thoroughly where the mica V-ring issues from under the commutator wires, the string or tape of which the band is composed should itself be thoroughly dipped and baked before being applied. If this is not done, when the armature is dipped the band will soak up the varnish in the seam and leave it entirely unprotected. As this is an extremely vulnerable part of the commutator, special emphasis should be placed on this point.

The varnish does cement coils in the slots, and this has been construed as an objection to the method by some engineers. However, it has been found that the occasions of reclaiming such armatures by replacing one or more coils are comparatively few. It may be safely said that the reduction in operating troubles amply compensates for the additional labor involved in stripping the coils of an armature when such trouble does occur.

Variations in baking periods of armatures were investigated by taking hourly insulation resistance measurements by means of leads brought out of the oven so that the oven doors would not have to be opened. In this test it was found that the time required to bring the armature to a standard resistance did not depend on the location of the armature with respect to the oven doors. This indicated that the radiation losses at that point were low. The position of the damper or the operation of the ventilating motor seemed to have little or no effect on the time required to obtain the standard resistance. It was found, however, that it did make a considerable difference in time whether the armature was in the upper or the lower tier. Although the temperature in the upper tier was 10 deg. to 15 deg. higher than the lower tier, nevertheless the armatures in the upper tier took a longer baking time to come up to the standard insulation resistance. In order to check this surprising result, the experiment was made several times on the twelve armatures with six in the upper tier and six in the lower, all positions being as nearly as possible the same. The result was found to be always alike.

In order to check the effect of lower baking temperatures, six armatures were baked in a steam-electric thermostatically closed oven, which was maintained at a temperature of 190 deg. Fahr. until all insulation resistance had been raised to 1 megohm or better. The armatures were then transferred to an electric oven, which was maintained at a temperature of 240 deg. Fahr. The insulation resistances immediately after the transfer to the electric oven were virtually the same as those which obtained immediately before removing the armatures from the steam-electric oven. However, after three hours of baking at 240 deg. the deflection increased to a value of 120 volts from the original value, which had been 10 volts at the time of the removal from the lower temperature oven. Tests were made with a 600-volt meter on a 575-volt circuit. It would appear, therefore, that the lower temperatures do not liberate as much moisture to be dispelled.

Bringing all undipped armatures up to a standard insulation resistance before dipping is desirable in that it gives more uniform results in subsequent baking, but it is not necessary if the armatures are to be dipped a second time.

In this plant the following routine has been adopted: Green armatures are baked overnight at an average temperature of 240 deg. Fahr. During the earlier hours of baking, all insulation resistances are found to fall rapidly to a minimum and then rapidly rise to the predecided maximum during the later hours of baking. It is manifest, therefore, that a single reading is not a reliable indication of the condition of insulation, but at least two readings should be taken to determine whether the insulation resistance is rising or falling. If an armature does not show a resistance of 1 megohm or more, it is kept in the oven as long as necessary. As a rule a fourteen-hour bake suffices.

The next procedure is to remove four or five of the green armatures for the first dipping. When these have been dipped they are placed in another oven and baked from three to five hours in preparation for the second dipping. By the time all of the armatures in the first oven have been handled in this way the first armatures placed in the second oven are ready for the second dipping. After completing the second dipping, the armatures are returned to the oven and baked for twelve hours or more. The armatures are then taken out and prepared for shipping. After baking the green armatures according to the indications of the voltmeter, the meter is used no more, but all armatures before being released are subjected to a 2,000-volt test from commutator to shaft. The twelve-hour to fifteen-hour baking of the green armatures, the three-hour to six-hour baking after the first dipping and the twelve to fourteen-hour baking after the second dipping total a maximum baking period of thirty-five hours and a minimum of twenty-seven hours. An armature is never passed under the minimum, and as a rule the minimum is exceeded by several hours, not because it is deemed necessary but because it is more convenient. During the entire baking period the oven damper is open about half way and the ventilating motor is operating. Each electric oven has a heating capacity of 120 amp. at 600 volts, but is operated at half this input. The duration of the baking period is not measurably affected thereby, and the work of the contact-breaking devices is made easier.

Cleaning of cores and spiders of armatures before rewinding makes for the uniformity in time required to bring the insulation resistance of green armatures to a standard value. Further improvement is to be obtained by giving repaired armatures a gasoline bath before baking the first time. The expense, delay in production and amount of gasoline to be handled would, however, be considered prohibitive in the majority of shops. Repaired armatures impregnated with oil and sludge may, after four or five hours of baking, give insulation deflections of from 400 volts to 525 volts out of a possible 600 volts. Subsequent baking frequently reduces the abnormal deflection to a safe value, but in refractory cases the armature is removed from the oven after the baking has had time to loosen the sludge, which is blown out with compressed air. How much this treatment is going to help in any particular instance can usually be foretold from the amount of dirt that the air releases. The relief is likely to be most decided on armatures the commutators of which have radials, as the dirt works through the clearances between the radials and deposits on the rear end of the commutator.

The dipping application referred to really constitutes a "rolling." The armature is supported on trunnions over a tank the lower part of which, containing the varnish, can be raised and lowered. The varnish level is kept such that when the lower part of the tank is raised the full radial depth of the winding is submerged. The armature is slowly turned several times, then permitted to rest several minutes, then slowly turned several times more, the varnish lowered and a draining period of five minutes allowed. While one operator is turning the core another is pouring varnish onto the string band or tape band at the end of the commutator. Special effort is made to give the band all the varnish that it will take. The armature then is lifted by means of an air hoist and let down onto a truck and shoved into the oven.

During the rolling it is necessary to keep the varnish at working consistency as it tends to thicken on account of the evaporation of the solvent. This is done by adding gasoline as required, about 5 gal. of gasoline being used with 15 gal. of varnish. The adding of the gasoline does not impoverish the varnish to the extent suggested by the proportions, because as the armatures are hot the solvent evaporates rapidly while the body of the varnish does not. Indeed, by adding the gasoline in small quantities at frequent intervals and stirring on each occasion the specific gravity of the varnish is maintained practically at prescribed value. The stirring tends to keep in suspension the impurities which the varnish washes out of the armature; therefore, on this account, it is necessary to clean the tank several times during a busy day.

E. C. PARHAM.

Brooklyn, N. Y.

Sparks Between Rotor and Stator May Be Caused by Loose Bars

WITH induction motors small sparks are sometimes seen between the rotor and stator. These may be due to the copper short-circuiting rings becoming loosened from the slot bars. The only remedy is to solder or weld the rings tightly to the slot bars. If not attended to, the stator winding is liable to become punctured. With a rotor of any size, say 25 hp., the heat for such a repair job must be supplied by a gas flame with air pressure.

H. S. RICH.

East Berlin, Conn.

How to Determine if Load Is Too Great for Motor

RECENTLY a case where a motor would not start properly under load came to the writer's attention. When the motor was installed on a chemical-mixing machine it was tried out with the machine empty, under which condition it ran satisfactorily. However, when the machine was heavily loaded it could not be made to start. An attempt was made to correct this trouble by changing to the next higher tap in the auto-transformer, but this was without satisfactory results.

After checking up all connections, line voltage and voltage at motor terminals, a lever was applied to the motor shaft, and by pulling on this lever at 1-ft. radius it was found that a pull of 114 lb. was required to start the machine and the motor to which it was geared. The motor was then moved away from the machine so that the gears were out of mesh. Then the lever was attached securely to the motor shaft and the spring balance was fastened to a stationary point and the starter handle was thrown to the starting position. The motor exerted a pull of 66 lb. at 1-ft. radius on the lever. From these results it was determined that the motor was not sufficiently large for the job. The motor in this case was a 20-hp., 220-volt, 1,160-r.p.m. two-phase machine. When a 40-hp. motor was substituted the machine started satisfactorily under heavy load.

East Orange, N. J. E. R. DEBMAN.

Graphic Study of Current Capacity of Several Wires in Conduit

GRAPHIC studies are presented herewith of the results of tests on current-carrying capacities of wires in conduit conducted by the Commonwealth Edison Company at the request of the Department of Gas and Electricity of Chicago, as set forth by Henry C. Horstmann and Victor H. Tousley in the ELECTRICAL WORLD, May 14, 1921, page 1099.

Plate I shows the copper cross-section necessary to carry different currents in one conduit and shows that for a certain current the total cross-section must be

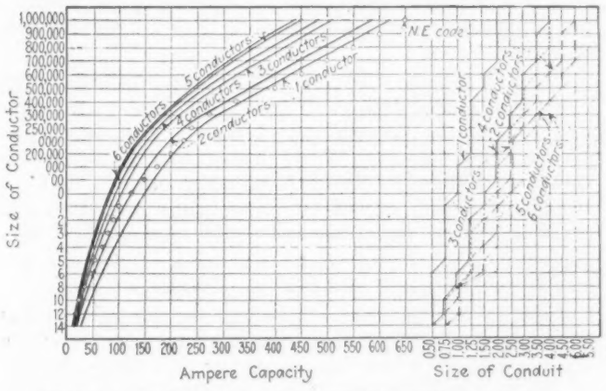


PLATE I—EFFECT OF USING SEVERAL CONDUCTORS IN ONE CONDUIT

National Electrical Code values are shown by circled points. Estimated values are shown by the lines. Wires are calculated to occupy 40 per cent of space in conduit.

greater when a larger number of small wires is used instead of a small number of large wires.

The true points of the National Electrical Code curve have been located for the sake of comparison. It may be noted that for large conductors the code allows a greater current than the curves show for conductors in the corresponding conduit, but less current for No. 10 and smaller conductors, four or less in a conduit. The curves show that for a current of 400 amp. two conductors of 600,000 circ.mil may be used in a 3-in. conduit. The code allows 450 amp. for 600,000 circ.mils.

Plate II shows that the code permits of much greater

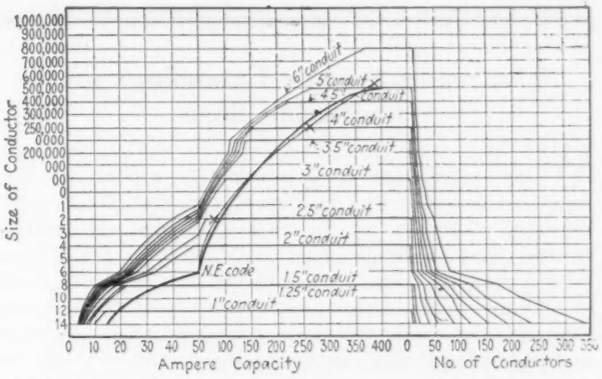


PLATE II—REDUCTION IN CURRENT-CARRYING CAPACITY CAUSED BY USING SEVERAL CONDUCTORS IN ONE CONDUIT

Shows number of conductors which may be placed in different sizes of conduit and current-carrying capacity when so placed. Wires caculated to occupy 40 per cent of space in conduit.

current in all sizes of conductor than the tests seem to indicate should be permitted. For example, from the curves in Plate II it may be seen that with No. 2/0 conductors in a 6-in. conduit the carrying capacity is 75 amp. for each of twenty-nine conductors as determined by the tests. The code, however, allows 150 amp. in No. 2/0 conductor.

In checking over the tables to develop the curves of the data shown, it was noted that for No. 5 conductor in 2-in. conduit Table I gave 79 amp. and Table II gave eighty-eight wires; it is believed that these values should be 69 and 8, respectively. As a line drawn through all the points in each column could not produce a smooth curve, each curve in Plate I was made smooth by further reducing the carrying capacity at some points by lifting the sags from the curves.

D. W. BLAKESLEE,
Jones & Laughlin Steel Co. Electrical Engineer.
Pittsburgh, Pa.

Radiant Heater Employed for Baking Small Coils, Etc.

OCCASIONALLY having a small rewinding job with no way of baking the coils after dipping in insulating varnish, the writer constructed a sheet-iron box, 30 in. square, having a hinged door and lined on the outside with several layers of asbestos sheets and thick cardboard. A 60-watt radiant heater was used for heating the interior, and it was found possible to raise the temperature to 180 deg. Fahr. in several hours. This makes a cheap, serviceable oven with an easily regulated temperature for baking either coils or entire small motors after the rewinding is completed.

The use of the heater for this purpose was first suggested by its use in drying out a 50-hp. motor which had been submerged. This was thoroughly dried out by covering over with an old tarpaulin and for several days maintaining a high temperature underneath with two 600-watt heaters.

L. A. TUCKER,
Superintendent.
Municipal Light and Water Commission,
Donaldsville, La.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Financing Service Extensions on a Profitable Basis

WITH the increased cost of labor and material and the high rate of interest for capital for new construction, said H. A. Doering of the Westchester Lighting Company at the recent commercial meeting of the Empire State Gas and Electric Association, utility companies have been forced to adopt the policy of making service extensions at their own expense only when they are good commercial propositions. Although in the smaller companies an occasional unprofitable extension may not be a vital matter, he pointed out that in a company operating over a large area hundreds of thousands of dollars could be easily invested and expended from which there would be no adequate return for a great many years.

Applicants for service, Mr. Doering continued, may be divided into two classes, desirable and undesirable. They are considered most desirable when the necessary investment is very small, requiring a service, a meter and perhaps the additional expense of changing a transformer or some small part of a secondary system. Applicants that are the least desirable, unless the income promised is very attractive, are those requiring an extension of plant.

If the investment is not warranted, the utility company is justified from a financial viewpoint in declining to make the extension. However, it is not always the best policy to refuse to make an extension; therefore many companies have devised methods of allowing the consumer to help finance the project, thereby enabling the prospective customer to obtain service and the company to furnish it without loss.

When the total cost of making an extension is more than the company should invest and the difference not very great, the amount required of the prospective consumer may be obtained by a direct contribution through mutual agreement, the company assuming its share of the cost and the prospective consumer paying the balance. These methods usually apply to the short extensions. When the cost is very great, a proposition can be submitted whereby the "prospect" does some of the work and contributes toward the cost of the remainder, for which amount he will receive a refund in accordance with future business taken on the extension. This plan applies particularly to developing companies and has worked out very well. Agreements are made whereby the applicant deposits with the utility company a specified sum. A proportion of this sum is refunded at the end of each year for a three-year or four-year period, provided that the revenue to the utility company from this particular customer in any one year is not less than a predetermined amount.

A sufficient return on capital invested will attract additional capital to provide for increased capacity and new extensions. Extensions should therefore be made on a profitable basis in order to maintain the return necessary to attract capital. This demands that those desiring service requiring unprofitable investment should help finance the extension under a plan best adapted for the utility company and the controlling circumstances.

To make the public more willing to do this it must be educated to realize the great value of electric service and that it is obtaining substantial returns in health, comforts and profits by the accrued benefits of the high engineering skill which makes the utility service so valuable to its customers. This is usually not appreciated until some temporary breakdown brings interruption.

"If we can get the people to ask, 'What would we do without this service?' " Mr. Doering said, "we shall have started them thinking in the right direction, and when we can get them to realize that the loss occasioned by unprofitable extensions must naturally be reflected in their purchase price of the service, it seems as if the few individuals particularly interested in a proposed extension would find little sympathy from the general public when these individuals object to doing their just share in financing a service extension."

Selling Stock to the Small Investor in a Consumers' Ownership Campaign

HOW best to reach the small investors—prospective buyers of only one or two shares of stock—frequently presents a puzzling problem in a consumers' ownership campaign. W. S. Webb, manager of the Cadillac (Mich.) district of the Consumers' Power Company, has offered some valuable suggestions for reaching the prospective small stockholder. From his experience he says:

"Our attention, since we commenced the sale of our 7 per cent cumulative preferred stock, has been largely centered on the volume of our sales. This is entirely proper, and the sale of as many shares as possible should continue to be our primary object, but the secondary object of selling to as many individuals as possible should be of almost equal importance. It is perfectly natural that we should think of persons with means as the most probable purchasers of our stock, and our sales records show that by far the greater part of our sales have been for cash. We have also recognized the value of the small sales of one or two shares, because of the fact that 'every little bit helps, but the importance of each sale should not be rated in proportion to the number of shares.

"Every sale means a new partner in the ownership of the company, whether he has purchased one share or one hundred. The sooner we can get even a single share of 'Consumers' into each shop, each office, each neighborhood, each unit of society where people meet and talk, the sooner will the ultimate success of our plans be

assured. For every purchaser is going to bring others, and every purchaser of one share on payments is going to be a prospect, already two-thirds 'sold,' for another share as soon as his first is paid up. We are pioneering now, and the road has to be cleared for each sale, but we cannot tell, when we sell one share now, how many shares that sale will lead to in the future.

"In 'talking stock' to people who are obviously 'prospects' for only a share or two, we find that two main considerations must be satisfied before a sale is made. First, of course, the safety of the investment. This is usually already assured in the person's mind except for one idea. We have repeatedly been told in one breath that the party 'would just as soon put his money into the Consumers' Power Company as to put it into the bank' and asked in the next, 'Why is the company so hard up that it needs this money now?' One should not fail to state at the outset of an interview that the proceeds from the sale of our stock are to be used for new construction work, to build new lines, purchase additional equipment or construct new dams, and not for the maintenance or operation of the present property.

"The mention of new power plants and new dams never fails to excite interest in this part of the state at least. The proximity of our Junction Dam, which many Cadillac people watched during its construction, and the general knowledge of the undeveloped resources of the northern rivers make a stronger appeal than descriptions and statistics of our present property. As an illustration of the fact that the company continually needs new capital, it is interesting to state the number of new customers connected during the past year in the home city, with an approximate statement of the necessary investment in meters and services alone.

"The next obstacle to overcome is the question of 'getting my money out if I need it.' Explanation that the company will resell the stock for the owner, and that a bank will usually make a loan of from 60 per cent to 80 per cent of the value of the stock with the certificate as security, is usually satisfactory. It may be added, however, that money in the savings bank is not necessarily available on demand, as it is written into the rules of almost all savings banks that the bank may request ninety days' notice that money is to be withdrawn. This privilege is seldom, if ever, used, but in case of panic it could be exercised. However, we frequently advise right here that a person should not desert the savings bank entirely to buy stock, and that it is not advisable to put one's last cent into the stock. In case of emergency, the money invested in 'Consumers' would be available on short notice, but it would be better to protect the investment by at least a small bank account also.

"A comparison of the return on a time-payment subscription to 'Consumers' preferred with savings bank interest is an illuminating example. Four per cent is the highest interest rate common among savings banks, and interest is usually paid only on what money has been on deposit during the whole of a three-months period or 'quarter.' Deposits made from time to time during a 'quarter' do not commence to draw interest until the next quarter. Partial payments on 'Consumers' draw 7 per cent interest from the time of payment, and a comparative example is given in the table.

"Many banks pay less than 4 per cent on savings accounts, and of course the method of paying interest varies, but this is probably a fair example of the relative return on 'Consumers' and savings bank deposits.

COMPARISON OF SAVINGS-BANK AND "CONSUMERS" INTEREST

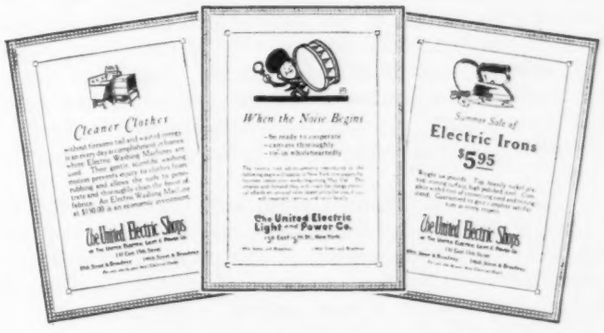
	Deposit in Bank	Interest Credited	Paid on Stock Sales	Interest Credited
Feb. 1	$10.00	..	$10.00	..
Mar. 1	10.00	0	10.00	$0.06
Apr. 1	10.00	0	10.00	0.11
May 1	10.00	0	10.00	0.17
June 1	10.00	..	10.00	0.23
July 1	10.00	$0.30	10.00	0.29
Aug. 1	10.00	0	10.00	0.35
Sept. 1	10.00	0	10.00	0.41
Oct. 1	15.00	0.60	15.00	0.47
Total	$95.00	$0.90	$95.00	$2.09
Each three months thereafter		0.95		1.75

"Whether a sale of stock is made or not, a talk for that purpose with one of the small consumers of the company is almost sure to be beneficial. In the first place the company is, by the very act of one of its employees making the call, offering to this party an invitation to join as a partner in the business, rather than trying to sell something. Previously, if this was not impossible to the person of small means, the opportunity was, at least, not made so easily available.

"No better opportunity has ever been offered for the company to get closer to its consumers and gain their confidence than through these friendly talks."

New York Company Co-operates in Appliance Advertising

THE United Electric Light & Power Company of New York City is using an interesting method of keeping the contractor-dealers and others in the city in touch with its advertising activities so that they may if they desire co-operate and derive the maximum benefit from the company's publicity. A series of appliance advertisements which is appearing in the New York evening newspapers throughout the summer has been prepared and printed in booklet form. The booklet also contains a schedule of the papers and the date on which each advertisement will be run. A copy of the booklet has been sent in advance to each of the



TYPICAL CO-OPERATIVE APPLIANCE ADVERTISEMENTS BY THE UNITED ELECTRIC LIGHT & POWER COMPANY

contractor-dealers in the city so that if they wish they can plan their advertising accordingly. Three typical advertisements are shown here.

With regard to the company's policy of co-operation with the dealers in appliance sales, Ralph Neumuller, advertising manager, said: "Standard prices are maintained in almost every piece of copy. Where, as in the case of the electric flat-iron, a special sale price of $5.95 for the months of June, July and August is shown, the electrical contractor-dealer has had, through his association, an opportunity to buy and sell such irons co-operatively with us at a satisfactory margin of profit."

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Alternating-Current Motors for High-Speed Elevators.—J. J. MATSON.—For passenger elevators which cover from 175 ft. to 300 ft. (50 m. to 90 m.) per minute and freight elevators which run from 100 ft. to 200 ft. (30 m. to 60 m.) per minute two speeds must be supplied, one of them a very low speed for making accurate landings. Heretofore it has been deemed advisable to supply direct-current adjustable-speed motors and to use a motor-generator set or synchronous converter for changing from alternating to direct current. Now, however, the author says, two-speed alternating-current motors are very satisfactorily adapted to this class of service. These motors have a single winding in the primary and a single high-resistance rotor winding. The motor speed is changed by means of an external pole-changing switch which connects the motor at either speed directly across the line.—*General Electric Review,* June, 1921.

Dynamos with Three Brushes.—M. IGLESIS.—This type of direct-current generator is used extensively for the illumination of trains and automobiles. By simply adding an auxiliary third brush for the excitation to an ordinary shunt-wound generator a fairly constant voltage is obtained within wide speed limits, if a storage battery is kept floating on the line. After describing the characteristics of such dynamos, the author gives the full theory, which, he claims, has never before been developed or published. Simple circle and curve diagrams serve to explain the new theory of such three-brush machines, which utilize the armature reaction and the distortion of the magnetic field. In the last part of the very detailed paper the author describes a few standard makes of such dynamos, gives their characteristic curves and shows their perfect accord with his theory and calculations.—*Bulletin de la Société Française des Electriciens,* Vol. I, No. 2 (1921), page 31.

Generation, Transmission and Distribution

Power Stations of Duquesne Light Company.—J. M. GRAVES.—A full discussion of the design features and operating considerations in connection with the Brunot Island and Colfax power stations.—*Electric Journal,* May, 1921.

Generating System of the West Penn Power Company.—G. G. BELL.—A discussion of engineering features and economies in power-plant design and operation as worked out for the system of the West Penn Power Company.—*Electric Journal,* May, 1921.

Electric Drive and the U. S. S. Tennessee.—H. M. SOUTHGATE.—The maneuvering power of the Tennessee, it is said, was demonstrated during the recent test, when a maximum speed of 21.378 knots was attained. The boat was brought to rest from maximum speed in less than three minutes, and a turning circle, with all propellers operating in one direction and with rudder hard over, was less than 700 yards, or about that of a destroyer. The economy was said to be from 5 to 10 per cent better than the guarantees.—*Electric Journal,* June, 1921.

Automatic Substations for Mining and Industrial Power Loads.—M. A. WHITING and C. E. H. VON SOTHEN.—The supply of mining and industrial loads by automatic substations is urged on economic grounds, and it is claimed that both quality and cost of service are effected advantageously by automatic operation.—*General Electric Review,* June, 1921.

General Arrangement of Propelling Machinery of the U. S. S. Tennessee.—W. E. THAU.—At normal full-load speed of 21 knots the power required is 28,000 hp. The propellers are driven by four direct-connected, two-speed, wound-secondary induction motors, supplied with three-phase power through suitable control equipment at approximately 3,400 volts and 34.6 cycles (full speed) by two 2,075-r.p.m. turbo-generators.—*Electric Journal,* June, 1921.

Traction

Electric Towing of Canalboats.—M. SCHLEICHER.—This paper reviews and criticises the existing methods of moving boats on canals by electric power. The system with a special, slow-moving locomotive running on a track along the canal is used to some extent, but has the disadvantage of being interfered with by boats loading or unloading at plants along the canal. The suggestion has been made to use a small electrically driven mule, running on overhead wires and controlled from the boat. Near industrial plants the mule could run at such a height as to clear any boats. Another system has been advocated using a motor-driven air propeller, installed temporarily on the boat, the motor collecting its current from a pair of trolley wires suspended above the middle of the canal. This system, like the electric mule equipment, is very costly and, besides, the efficiency of an air propeller for such low speeds is very poor. Finally, as the best existing solution, the storage-battery-driven towboat is considered. The author gives an elaborate power and cost estimate, which shows, however, that this system is too costly. He therefore comes to the conclusion that for towing boats along canals the steam engine and the gas motor are as yet superior. He suggests that further research be made to find a reliable and cheaper electrical method. —*Elektrotechnische Zeitschrift,* May 12, 1921.

Important Novelties for Street Railways.—F. HARTMANN.—The author, who is the superintendent of the Vienna street railways, reports experiences with new street-railway material. Iron trolley wires used during the war because of the copper shortage were very unsatisfactory on account of rusting and consequent arcing. The newly introduced carbon-lined-arch current collector used on Viennese trolley cars is satisfactory if used exclusively on the entire system, but gives poor results if used together with aluminum-lined collectors. A lay-out of the overhead wire in zigzag is essential to

prevent grooving of the carbon sleeve. Good results were obtained from a novel dust-proof shaft boxing, a section of which is shown. A new model of brake-shoe construction, which permits of the complete use of any shoe, gave excellent results. Recently a peculiar loose-bolt shaft oiler has been installed on some of the motor bearings. For this a very effective and uniform lubrication is claimed.—*Elektrotechnik Maschinenbau*, May 29, 1921.

Main-Road Electrifications in Austria.—C. WALCH.—This article is an abstract of the officially accepted electrification program of the new Austrian Republic, which was definitely passed on July 23, 1920. It is expected to finish the four main branches before the end of 1925. A detailed description of the Austrian main roads which are to be electrified is given, together with a description and sketches of the four types of locomotives, all of them 15,000-volt, 16⅔-cycle alternating-current machines. (For details of these locomotives see also *Electric Railway Journal*, April 2, 1921, page 644).—*Elektrotechnische Zeitschrift*, May 29, 1921.

Installations, Systems and Appliances

Operation of the Surge Arrester.—C. E. BENNETT.—An explanation of the well-known Bennett surge arrester for dissipating transient voltages on transmission systems.—*Ohio Electric Light Association Monthly*, May, 1921.

Underlying Principles of Electrical Ignition.—BENJAMIN F. BAILEY.—A concise development of the theory of ignition both by battery and magneto.—*Journal of Society of Automotive Engineers*, June, 1921.

Government Armor-Plate Factory.—SIDNEY G. KOON.—Some interesting installations of electric furnaces for heavy service are described, together with the operation of 40-ton Heroult electric furnaces.—*Iron Age*, May 26, 1921.

The Minden Pumping Station for the Ems-Weser Canal.—K. STEINNER.—For the operation of the Ems-Weser canal between Hanover and Minden a main and an auxiliary pumping station were erected in 1912-13, taking water from the River Weser. In the main plant are installed four units, each for 120 cu.m. of water per minute and 14-m. lift, driven by 625-kw., 50-cycle, 375-r.p.m., 6,000-volt induction motors. The auxiliary plant has two pumps for 60 cu.m. water per minute, driven by 440-kw. induction motors. The pumps are of the centrifugal type with horizontal shaft and have their intake at both sides, so as to obviate any lateral forces. A special air-pumping apparatus is available to remove the air from the pump casings at starting. The induction motors have wound rotors and are started with resistors in the slip-ring circuit. After attaining full speed the collector rings are short-circuited and the brushes lifted.—*Elektrotechnische Zeitschrift*, May 26, 1921.

Electrochemistry and Batteries

Dielectric Constants of Electrolytic Solutions.—R. T. LATTEY.—A discussion of the divergent view of different observers concerning the change in the dielectric constant produced by dissolving electrolytes in water.—*Philosophical Magazine*, June, 1921.

The Paper Industry.—H. W. ROGERS and E. E. WARNER.—A discussion of the application of motors to the paper industry, which the authors state has jumped to about fourth rank in primary horse-power used. It is said that about 500,000 hp. of electric drive are used.—*General Electric Review*, June, 1921.

Units, Measurements and Instruments

Reactive Volt-Ampere-Hour Meters.—J. W. WEST.—The writer deals with conditions leading up to the demand for these meters and demonstrates mathematically how they serve the purpose.—*Ohio Electric Light Association Monthly*, May, 1921.

Telegraphy, Telephony and Signals

Application of Radio to Navigation Problems.—REAR ADMIRAL W. H. G. BULLARD.—Among the interesting applications of radio in navigation are mentioned the determination of difference in longitude, the sending of weather reports to ships at sea, and the use of the radio direction finder in determining the bearings of a ship at sea. More recent developments have been the use of radio in directing ships through narrow channels by means of a directive pilot cable and the determination of the depth of water. Laboratory tests, it is said, show that the reception of 600 words per minute has been attained by recording photographically.—*Journal of Franklin Institute*, June, 1921.

Reception of Radio Signals by Sense of Taste.—ALFRED N. GOLDSMITH and EDWARD T. DICKEY.—The purpose of this research was to determine the feasibility of reception of radio-telegraphic signals by the sense of taste. Electrodes were made which could be placed against the tongue in such a way as to cause a taste sensation when a source of potential was connected to them. Tests were made, using low-potential direct-current and 60-cycle alternating current, to ascertain the amount of energy and potential necessary for taste reception. The reception of actual signals from an antenna was tried. It was found impossible by using four stages of amplification to obtain taste sensations from all signals the audibility of which was greater than 500 in the detector circuit. The results obtained thus indicate that from an electrical standpoint it is possible to receive radio-telegraphic signals by the sense of taste. When compared to the sense of hearing or even of sight, however, the sense of taste is much inferior as a means for receiving intelligence.—*Proceedings Institute of Radio Engineers*, June, 1921.

Miscellaneous

A Recently Developed Dust Explosion and Fire Hazard.—DAVID J. PRICE.—The improper installation and adequate protection of incandescent lamps and circuits constitute a fire and dust explosion hazard in dusty industries. Methods of preventing such explosions are discussed.—*Circular No. 171, Bureau of Chemistry, U. S. Department of Agriculture*, May, 1921.

Electrical Manufacturing Tendencies in the United States of America.—A. M. RANDOLPH.—The writer refers to standardization of production and research and other tendencies among American manufacturers, which he considers have an important bearing on the possible export of electrical machinery from the United States.—London *Electrician*, May 20, 1921.

Recent Improvements in Steam-Turbine Design.—The products of the English Electric Company are dealt with in this article. This firm, it is said, first introduced the "disk and drum" or hybrid Curtis-Parsons machine, but now favors the pure-impulse type. The machines manufactured by this company are said to range from 100 kw. at 5,000 r.p.m. to 30,000 kw. at 1,500 r.p.m.—London *Engineer*, May 27, 1921.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

AMPLIFIER, THERMIONIC, OF VARIABLE AMPLIFICATION RATIO.

A means has been found by which the amplification ratio of a vacuum-tube amplifier may be varied without changing the input impedance of the tube as a whole. Two tubes are used, and the signals amplified by the first are impressed on a variable resistance by inductive action. The input terminals of the second tube are shunted around this variable resistance, so that any desired part of the potential drop across the resistance may be impressed upon them. This gives any desired amplification ratio in the output of the second tube, and the impedance of the whole amplifier to the incoming signals has a substantially constant value.—*Western Electric Company, Ltd., London, England.*

CORONA, WAVE FORM OF.

A study has been completed of the wave form of the discharge of the high-voltage corona and its bearing on the indications of the corona voltmeter. By using a thermionic amplifier for magnifying the indications of the corona voltmeter it has been found possible to use a portable needle instrument and also a loud-speaking telephone as indicators of the first appearance of corona.—*J. B. Whitehead and N. Inouye, Johns Hopkins University, Baltimore, Md.*

IGNITION TEMPERATURE AND SPONTANEOUS IGNITION OF VARIOUS MATERIALS.

Data have been collected on the ignition points and the spontaneous ignition of various important materials used in the principal industries. Among the materials investigated were newspaper stock, motion-picture film and a wool and cotton insulating felt.—*Bureau of Standards, Washington, D. C.*

INDUCTANCE OF CIRCULAR COILS OF RECTANGULAR CROSS-SECTION.

Tables have been prepared which reduce the calculation to the simplest kind of an arithmetical computation. In the preparation of the tables formulas due to Lyle, Dwight and Butterworth have been used, that formula being chosen in each case which gave the best convergence. The tables enable the inductance to be found with an accuracy of better than one part in ten thousand for the ideal case of uniform distribution of the current over the cross-section. The correction for the space occupied by insulation is small in the case of coils of round wire, wound closely in a rectangular cross-section, and unimportant in the case of "honeycomb" coils.—*F. W. Grover, Union College, Schenectady, N. Y.*

INDUCTANCE OF COAXIAL CIRCLES.

New formulas have been derived for calculating the coefficient of inductance of coaxial circles. The method is based on the computation of elliptic integrals, using scales of arithmetic geometrical means. A comparison with the older formulas in use shows a marked advantage of the new method. A complete account of the proposed method has been communicated to the Royal Society of London.—*Louis V. King, McGill University, Montreal, Canada.*

INSULATING MATERIALS, CONDUCTIVITY OF NEAR BREAK-DOWN VOLTAGE.

In a series of tests on the conductivity of insulating materials near the break-down voltage the recording instruments used were protected from injury in case of puncture by placing an insulated hot cathode rectifier in series with the sample being tested, so that the current through the sample could be limited by controlling the temperature of the hot cathode. When with a given applied voltage the current did not reach a constant maximum value upon raising the cathode temperature the voltage had reached the break-down point. Three classes of insulating materials were found, viz., (1) those which obey Ohm's law throughout, (2) those which obey Ohm's law up to near break down, and then the conductivity increases at an accelerated rate, and (3) those for which the conductivity increases over the entire range of voltage at an accelerated rate to break down. Materials in the third general class have the greatest dielectric strength, and those in the first class the least. Results have been obtained for untreated cement paper, paraffined fishpaper and black treated cloth, which are taken as representative respectively of the three classes.—*J. E. Schrader, Research Laboratory, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

KENOTRON, STUDY OF.

A theoretical study is being made of the pulsations of direct-current voltage as obtained from a kenotron tube with various methods of connection.—*E. J. Berg, Union College, Schenectady, N. Y.*

LAMP, PROJECTION, FOR MOTION PICTURES.

A new incandescent lamp has been developed for motion-picture projection. The principal distinctive feature is the filament supports, which are arranged to hold the filament loosely so as to allow for varying contraction of the filament and supports when the lamp is turned on and off. The supports are also arranged to prevent the distortion of the filament, and as a result the lamp better maintains its candlepower throughout life.—*N. E. L. A. Lamp Committee.*

LAMP, MILL TYPE.

A new incandescent tungsten lamp has been developed to replace inefficient carbon lamps in places where lamps are subjected to rough treatment. Tests indicate that the new lamp is mechanically about five times as strong as the regular tungsten lamp.—*N. E. L. A. Lamp Committee.*

MAGNETIZATION IN IRON.

An experimental investigation is being carried out on the effect of magnetization upon the atomic structure of iron. Very little work has been done in this field heretofore.—*W. P. Davey, Research Laboratory, General Electric Company, Schenectady, N. Y.*

MERCURY VAPOR, CONTINUOUS SPECTRUM FROM.

Under certain conditions the discharge through mercury vapor gives a green glow which shows the ordinary line spectrum of mercury vapor together with one which is continuous from the red into the ultra-violet, being very prominent in the green. This is the same spectrum as that shown by fluorescent mercury vapor. Two conditions are necessary for obtaining this by an electrical discharge with any considerable brightness—the discharge must pass through hot mercury vapor that is not very far from the point of condensation, and the current density must be small. As the current density is increased the line spectrum becomes more prominent and the continuous spectrum less so.—*C. D. Child, Colgate University, Hamilton, N. Y.*

WHEATSTONE BRIDGE FOR CAPACITY AND INDUCTANCE.

A universal bridge for measuring inductance and capacity with the maximum simplicity, rapidity and accuracy has been designed. The instrument is compact and allows the making of a very large number of standard bridge-method tests.—*Developed by the late C. V. Drysdale, London, England.*

Suggestions for Research

COOLING OF TRANSFORMERS AND ALTERNATORS BY REFRIGERATING MACHINE.

It has been claimed that refrigerating machines may be advantageously used in certain cases for cooling transformers and other electrical machinery. A small refrigerating machine sufficient to care for normal load may be used to care for the maximum power demand by overcooling it. Investigation is desired as to the practibility and resultant economy of such an arrangement. This plan has been successfully tried recently in Europe.

COMMUNICATION CIRCUITS, RESONANT SHUNTS FOR.

The use of resonant shunts, similar to those used on power lines, has been proposed for communication circuits. Such shunts have been used where telegraph service is disturbed by the fundamental frequency of nearby power circuits and have proved successful in telegraph lines paralleling 25-cycle and 60-cycle power systems. Investigation is desired as to their applicability on telephone circuits.—*Inductive Interference Committee, N. E. L. A.*

CURRENT TRANSFORMERS, DIFFERENTIAL.

There is a need for development in the design of current transformers so that one-half of the secondary winding can be reversed, thereby giving a differential transformer.—*Meter Committee, N. E. L. A.*

CURRENT TRANSFORMERS FOR LARGE INSTALLATIONS.

Most current transformers at the present have been designed for station use, and less attention has been paid to types for metering large installations. The demand for this kind of service has increased rapidly during late years, and it is desired that special consideration be given to the requirements for transformers used for this purpose.—*Meter Committee, N. E. L. A.*

ELECTROSTATIC FIELD, MEASUREMENT OF INTENSITY OF BY POLARIZED LIGHT.

It may be possible to measure the intensity of an electric field by observing its effect upon a beam of polarized light passed through a small crystal.—*A. S. Langsdorf, St. Louis, Mo.*

FIRES IN INSULATING OIL FROM ELECTRICAL BREAK-DOWNS.

An investigation is desired upon the effectiveness of the so-called Foamite system for fighting oil fires in electrical apparatus. The system has been employed by various oil companies in fire fighting, but its advantages for oil fires from electrical breakdowns, under the conditions obtaining with transformers, circuit breakers, etc., are yet to be shown. One of the N. E. L. A. committees recommends such research.

GLASS, CONDUCTIVITY OF.

Glass in the liquid state and at comparatively high temperatures is a conductor of electricity. The use of electrically heated glass furnaces may be the solution of a large number of problems connected with the production of certain kinds of glass. There is a need for research in this field, particularly to obtain accurate measurements of the resistance of known glasses, to arrive at the variation of the resistance with the temperature, and to find the effect of variables such as "stones," "bubbles," etc., in the glass.—*F. L. Bishop, University of Pittsburgh.*

MAGNETIC STORMS, EFFECT ON TELEGRAPH AND CABLE LINES.

During certain magnetic disturbances and auroral displays the generated earth currents caused serious interruption on telegraph and cable lines. The general effect of magnetic disturbances is to diminish the intensity of magnetization of the earth's field, in severe cases as much as 10 per cent. Further research in this field is desired.—*L. A. Bauer, Washington, D. C.*

POTENTIAL TRANSFORMER, DESIGN OF.

An improvement is desired in the construction of secondary leads, bushings, etc., in potential transformers so that oil will not siphon up through the leads and leak around the bushings. —*Meter Committee, N. E. L. A.*

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Col. Kelly Found Europe Watching Our Water-Power Law Operation

COL. WILLIAM KELLY, the chief engineer of the Federal Power Commission, has returned from a visit to England and France, where he conferred with government officials in charge of water-power matters. He found that officials in both France and England were watching with much interest the effect of the recent water-power act on American development. He pointed to the presence of the French Commission in this country as an evidence of the interest France is taking in this subject.

While Col. Kelly found that financial conditions in France are such as to preclude any great amount of hydro-electric development there at this time, he was surprised to find that plans are practically in complete form for a number of important projects. Principal among them is the development of the Rhone which is expected to furnish power for the Paris district and for the electrification of some railroads.

Col. Kelly familiarized himself with the work being done by the British government on the problem of utilizing the tides for power purposes. Considerable work along the same line is being done by the French engineers.

New England Utilities Escape Heavy Storm Damage

WITH the exception of the Edison Electric Illuminating Company of Brockton, Mass., public utilities in New England were fortunate in escaping serious interruptions of service during the unprecedented rain and thunderstorms which swept over the territory centering around Boston at the end of last week. At Brockton the failure of dams unconnected with company operations flooded the basement of the East Bridgewater generating station and cut off the blowers, necessitating reliance upon natural draft. This forced a reduction of load from about 9,000 kw. normal output to about 2,500 kw. Monday morning and a corresponding loss in power load. By Monday night the removal of flood water by pumping had enabled the load to be increased and about 5,000 kw. was taken on Tuesday morning, with every expectation of early resumption of virtually normal load.

The New England Telephone & Telegraph Company suffered a maximum of about 3,000 lines out of commission, due chiefly to the flooding of manholes and to overhead line troubles resulting from high wind. About 6.3 in. of rain fell in less than twenty-four hours. The New England Power Company had little trouble in central New England beyond temporary disturbances due to lightning and the slight flooding of an industrial substation at Fitchburg. The Tenney companies at Malden, Revere and Salem, Mass., escaped serious damage and the Narragansett Electric Lighting Company, Providence, R. I., reports little trouble. The Edison Electric Illuminating Company of Boston sustained some interruption due to lightning and the flooding of manholes, basements, etc., and a short-circuit in the Roxbury district. Taxicabs were commandeered for fuse replacement work and rapid restoration of service was pushed. Street lighting service in Roxbury was cut off for a short time and the Edison-New England power tie line was shut down temporarily. The total physical damage to the system was slight.

Non-Power Dam Proviso to Prevent Water-Power Interference

SO AS NOT to establish a precedent which might interfere with the future use of water for power purposes, the Senate committee on commerce has worked out a proviso which is to be made a part of future authorizations for the construction of dams for non-power purposes. The proviso reads as follows:

> That the consent hereby given shall terminate and be at an end from and after thirty days' notice from the Federal Power Commission, or other authorized agency of the United States, to said company or its successors; that desirable water-power development will be interfered with by the existence of said dam; and any grantee or licensee of the United States proposing to develop a power project at or near said dam shall have authority to remove, submerge, or utilize said dam under such conditions as said commission or other agency may determine, but such conditions shall not include compensation for the removal, submergence, or utilization of said dam if the water level to be maintained in said power project is higher than the level of the crest of said dam.

The proviso was made a part of the bill giving authority to the Trumbull Steel Company to construct a dam across the Mahoning River near Warren, Ohio. With that proviso, no further objection was offered to the measure, and it was passed. The House accepted the amendment. A similar bill authorizing the construction of a dam across the Wabash River at Huntington, Ind., also has been approved by both houses.

Ogden, Utah, Has Model Electrical Home

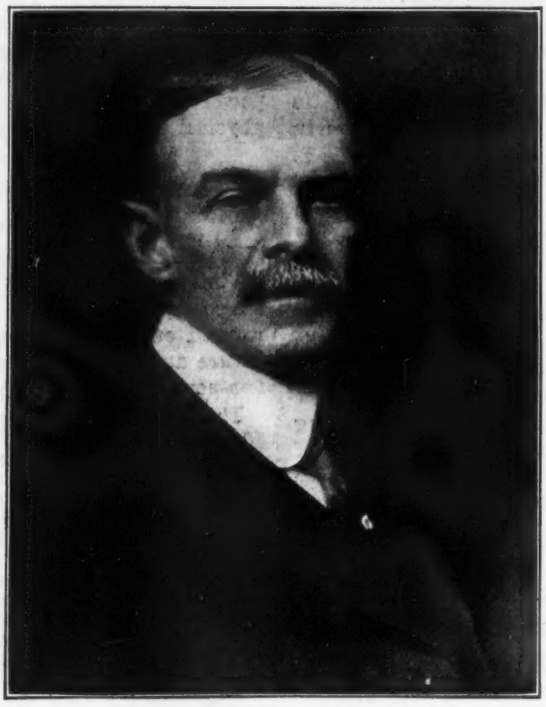
OGDEN'S model electrical home was opened for the first time to the general public on June 18. The visitors found in the home a complete showing of the latest and best methods of installing a modern home-lighting system and a large number of electrical labor-saving devices. From the beautiful light fixtures at the front entrance to the lighting switch at the garage door, in the basement, the electrical equipment is complete.

The companies that have joined in the enterprise are the Lighthouse, Utah Power & Light Company, Redfield Electric Company, Larison Electric Company and Ogden Electric Supply Company. The home was open every afternoon and evening from June 18 to 27 from 2:30 to 9 p.m.

Prof. F. B. Crocker, Father of American Electrical Standards, Dead

PROF. FRANCIS BACON CROCKER, one of the best known of American pioneers in electrical manufacturing, engineering and teaching, died at his home in New York City Saturday evening at the age of sixty years. Prof. Crocker had suffered from an incurable malady almost continuously for many years.

Born in New York on July 4, 1861, he was graduated from the School of Mines at Columbia University in 1882. A year later with Charles G. Curtis he formed the firm of Curtis & Crocker, patent attorneys and patent experts. Much of the spare time during this period was spent in research and resulted in a number of inventions. In 1886 the two partners established the C & C Electric Motor Company, from which he resigned two years later. At that time he joined with Schuyler Skaats Wheeler, with whom he had been associated for some time, in the formation of what is now known as the Crocker-Wheeler Company. The next year he took charge of the newly established department of electrical engineering at Columbia, becoming full professor in 1893. He remained in that work until the discomfort of poor health twenty years later caused him to resign.



FRANCIS BACON CROCKER

Many have been his contributions to the development of the electrical art. With his fellow workers Curtis and Wheeler he created the commercial motor of standard specification. As father of American electrical standards, however, he will probably be best known in the engineering profession. He was chairman of the A.I.E.E. committee which drew up the original standardization rules as well as of the committee which revised them. Besides he was chairman of the conference of insurance and engineering representatives that formulated the National Electrical Code. To him also is credited the choice of the name "henry" as the international unit of inductance.

So long as his health permitted he was very active in the industry. He has held many important offices in the American Institute of Electrical Engineers, of which he was a past-president. He was also president of the Electric Power Club and a past-secretary of the International Electrical Congress. His writings have been numerous and include a two-volume treatise on "Electric Lighting" and one on motors. His latest contribution to electrical literature was on the subject of temperature rating of motors and appeared in ELECTRICAL WORLD April 30, page 977.

Professor Crocker was a man of many friends, to whom the news of his death came as a great shock. His determination to master science rather than let science master him made his life one of constant graciousness. Some of those who knew him for a great many years and worked with him have made the following tributes to his memory.

Advocate of Quality

Prof. Crocker was remarkable for flexibility, adaptability and responsiveness. He was very clear-headed and, as every one knows, intelligent. His judgment was excellent. These qualities led to his opinion in conference being sought by several of our greatest inventors. The position he occupied in this respect is unique and I know of no other man in the world's history who has performed a similar function. He was the partner in invention with, or the collaborator with, in their respective important inventions in different lines, Charles G. Curtis, who got up the C & C motor and the Curtis turbine; Charles S. Bradley, whose numerous inventions parallel those of Tesla; Peter Cooper Hewitt in aviation, and, of course, devices, etc., used by the Crocker-Wheeler Company.

He was a leader in bringing about standardization and was a great believer in simplifying things and in expounding problems in a way that every one could understand. He believed with me that things should not be made to appear complicated or "technical" to the public, but simple, and he had a remarkably clear, concise and at the same time easy and interesting writing style. These two characteristics made him much in demand as a lecturer and writer and made a success of the electrical course which he established at Columbia.

He was fair and impartial and of a judicial turn of mind, being almost able to see the other fellow's side more clearly than his own.

He always and consistently advocated a good quality of work and scientifically correct design.

He, Charles G. Curtis and myself have been associated and in almost constant contact about technical matters for forty years, which I am inclined to think is a longer span of active co-operation than was enjoyed by any of the numerous other teams of electrical men, such as Thomson and Houston; Arnoux and Hochhausen; Sprague, Duncan and Hutchinson; Goulard and Gibbs; Stanley, Kelly and Chesney, etc.

SCHUYLER SKAATS WHEELER.

No Place for Empiricism

Francis Bacon Crocker was a great pioneer in electrical engineering. The history of electrical technology in the United States will be always associated with his name. The Crocker-Curtis motor of 1884 was the foundation of the C & C Motor Company and it was a wonder of efficiency for those days and for the size of the motor. It is the earliest monument to Crocker's life-long faith that empiricism has no place in the art of designing electrical machinery. When he became the technical head of the newly founded department of electrical engineering at Columbia University he became the leader of those men who believed that there is such a thing as the science of electrical engineering which is entirely distinct from every other engineering and from physics and that it has nothing in common with empiricism. It was that belief which inspired Crocker's magnificent work on electrical nomenclature and standardization.

Most of the successful electrical inventors in the United States knew Crocker and sought his advice, and they relied upon the verdict of his unerring judgment. The technical schools of the United States accepted the verdict of his judgment when in the organization of their electrical engineering departments they followed the program first mapped out by him at Columbia.

I have known Crocker for thirty-two years; during twenty-two of these years we were colleagues at Columbia University and saw each other almost every day. He was really my teacher and the only teacher in electrical

engineering, and I was never as happy as when Crocker consulted me on pure theory and accepted my opinion. Few mortal men can fill the place once occupied by Crocker. Few professors can captivate the heads and hearts of students as Crocker could, and few were admired as much as Crocker was admired by his students and by his former students. M. I. PUPIN.

Prof. Crocker's death removes one of the outstanding pioneers of the electrical industry. His work and teaching as founder and head of the school of electrical engineering of Columbia University contributed much to the growth and importance of the electrical development of this country.

As the first chairman of the standardization committee of the American Institute of Electrical Engineers, Prof. Crocker's painstaking work earned the lasting gratitude of everyone connected with the electrical industry throughout the world. THOMAS A. EDISON.

I regret very much to learn of the death of Prof. F. B. Crocker. He was one of the early pioneers whose work has left its impress on the art, while his services to the profession in many capacities have been invaluable. Of a most attractive personality he was esteemed by all who knew him. My own friendship with him covers nearly forty years past. ELIHU THOMSON.

Deserves Credit for Standardization

The electrical industry mourns the loss of one of its eminent leaders and educators in the passing away of Prof. F. B. Crocker, one of the pioneer workers in the field of electrical applications. He brought to his activities in the educational field a thorough grasp of the commercial and practical problems of the industry which made the electrical engineering course of Columbia University a model of sound practical teaching. He deserves the greatest credit for initiating the work of standardization in the electrical industry and the original standardization rules of the American Institute of Electrical Engineers formulated under his chairmanship bear the impress of his thoroughly practical and constructive viewpoint. He had a proper appreciation of the difficulties encountered by the pioneer workers in the field and he was deeply interested in having a proper record of the early history and successive stages of progress in the art. He will be mourned by a large circle of friends and co-workers who have in the past few years missed his earnest and interested co-operation. JOHN W. LIEB.

Prof. Crocker has been a force for advancing the sciences and arts associated with electrical engineering. His efforts which resulted in the establishment of the standards committee of the American Institute of Electrical Engineers in 1898, of which distinguished committee he was for many years chairman, has had much influence upon the electrical engineering arts in this country. He has also been of influence in improving international standardization in electrical engineering; the internationalization of electrical and magnetic units was close to his heart. His inventions and writings have also been of service in the development of electrical engineering. All electrical engineers pay tribute to Prof. Crocker and all who know him will pay it not only on account of his ability and service in the profession but also on account of his delightful characteristics as a friend. DUGALD C. JACKSON.

Prof. Crocker's death closes a career of achievement and work faithfully performed by a genius of rare ability. The results of his life work will remain as a permanent benefit to the electrical industry and will be an inspiration to future generations of electrical engineers.

JAMES BURKE.

Will Be Remembered as an Engineer

Prof. Francis B. Crocker laid the foundations of electrical engineering at Columbia; but although he was eminent as a teacher it is especially as an engineer that he will be remembered. He was an unusually gifted designer of electrical machinery. In his chosen fields of study, such as the theory of high-potential direct-current generators and motors and of the automatic regulation of alternating circuits, he had few equals. EDWARD J. NICHOLS.

The death of Francis B. Crocker will be deplored by all who have come in contact with him. For almost a quarter of a century throughout his interest in international standardization I have had the opportunity of meeting him and of appreciating the devotion and enthusiasm which he brought to his task. A high type of gentleman, a man of vision as is evidenced by his early work in connection with the founding of the Crocker-Wheeler Company, and also by his career as a teacher of electrical engineering at Columbia University, Professor Crocker will long be remembered as one of the notable figures among the electrical engineers who have created and shaped the great industry in the promotion of which we all are engaged. B. A. BEHREND.

Brought Practical Point of View to Teaching

In the death of Prof. Crocker our civilization sustains the loss of one who pioneered for a third of a century as university man and engineer. He carried a leading part in the generation which has followed that of gramme and which has taught the world the intelligent and abundant use of dynamos and motors. In developing the university curriculum in electrical engineering he acted with extraordinary energy and wisdom from the beginning. He demonstrated the necessity for the teacher to engage in practice as well as in study. The fundamentals of electrical action were discovered in the university. Professor Crocker showed by his life and example that the university has a corresponding work to do in the development of the great industries that are founded upon such discoveries.

HARRIS J. RYAN.

I greatly regret to learn of Prof. Crocker's death and wish to add my tribute to that of others in recognition of his ability as an educator and his pioneer work in the field of electrical development. BION J. ARNOLD.

His Opinion Widely Sought

The death of Prof. Crocker is the loss of an old friend whose keen and sound judgments were highly valued. He was one of the great figures in the early days of electrical developments who remained conspicuous, beloved and honored to the last. Above all things he was level headed and judicious and his opinions were therefore widely sought and respected. His loss removes one of the finest characters among the pioneers of electrical engineering and is deeply felt by a host of friends old and new. LOUIS BELL.

Prof. Crocker's brilliant work in his design of electric motors, the arc furnace and the chemistry of the primary battery at a time when these were virgin subjects resulted in his selection by Columbia to create its department of electrical engineering, one of the first in the country, and in his selection a few years later for the presidency of the American Institute of Electrical Engineering. He was the principal founder of the whole movement for uniform electrical standards and a large contributor to the progress of dynamo-electric machinery and also largely responsible for the creation of the international electrotechnical commission. His books are clear and constructive, and his engineering judgment always sane and balanced. His principal qualities were characterized by an unusually high sense of honor and loyalty, the electrical art notes the passing of a fertile and constructive pioneer and a large circle mourns a rare teacher and a rare friend.

GANO DUNN.

Electrical Workers' Strike Darkens Chicago Streets

SOME sections of Chicago were dark all the night of July 12 as a result of the strike of city electrical workers which began at 1 p.m. on July 12 and was settled at 10.30 p.m. the same night. The strike was called when the City Council finance committee refused increases to thirty-nine telephone operators, engineers and substation watchmen and granted increases averaging $1 per day to 300 other men on the municipal electrical force. Conferences lasting through the day had failed to prevent the strike. It was not until the chief of police threatened the strikers and their leader with indictments for manslaughter and murder if any crimes or accidents resulted from the lightless streets that the strikers capitulated. The substation supplying the downtown section was cut in and other substations followed until by midnight 60,000 of the 62,000 street lamps were burning. According to the City Council the pay increase demanded is still undecided and will come up for discussion at a later date.

Commonwealth Edison Brings Out Six Million 6s at 6¾ per Cent

TO REIMBURSE capital expenditures the Commonwealth Edison Company has sold to a large underwriting syndicate $6,000,000 of 6 per cent first mortgage gold bonds dated Sept. 1, 1908, and due June 1, 1943. The bonds are being offered to investors at 91½ yielding about 6¾ per cent. All former issues now outstanding bear a 5 per cent interest rate.

The company has 485,000 customers at the present time, having added 59,967 or 14.5 per cent during 1920.

Attleboro Company Reduces Rates

FOLLOWING conferences between the Attleboro (Mass.) Chamber of Commerce and the Attleboro Electric Company a reduction in rates for both lighting and power service has been announced, effective July 1. Lighting service is now billed at 11 cents net per kilowatt-hour instead of 12 cents. The net price of power in the new schedule ranges from 6 cents per kilowatt-hour from zero to 1,000 kw.-hr. to 2.25 cents for 20,000 kw.-hr. and above. Of the sixteen blocks of energy classified in the power rates, twelve were decreased. The four classes increased include the largest users, who now pay about 3 mills per kilowatt-hour more than before. The old schedule ranged from 7.7 cents to 1.925 cents. The minimum charge remains unchanged. In arranging the new schedule it was pointed out by the company that some of the large power business was being done at a loss and at a lower rate than is enjoyed by some of the larger customers of the Narragansett Electric Lighting Company in Providence, R. I., which supplies energy to the Attleboro Company. About $8,000 per year will be saved the customers of the Attleboro Company by the new schedule. Highly complimentary comment has appeared in the Attleboro press regarding the harmonious negotiations which have been conducted by the local trade organization and Edgar Tregoning, superintendent of the Attleboro Company.

Non-Water Power Application Approved

AFTER having heard from the chief of engineers in person as to the application of the Arkansas Hydro-Electric Development Company, the Federal Power Commission at its meeting on July 11 withdrew its objection and voted that the project will not affect the interests of interstate commerce. The project is on the Little Red River in White and Cleburne counties, Arkansas. The company proposes to build a dam near Judsonia to raise the water to a 60-ft. level and to build a second dam near Higden to raise the water level 70 ft., thereby storing some 9,000,000 cu.ft. of water. The chief of engineers held that the Little Red River above Bee Rock, 6 miles below the proposed development, is not navigable. Even below that point it is navigable only by back water from the White River.

Action on the application of the Wisconsin-Minnesota Light & Power Company and on the application of C. E. Loose was deferred until the next meeting of the commission.

The commission approved applications in the following cases:

Project No. 17.—Preliminary permit in favor of Western Tie & Timber Company for power development near Eminence, Shannon County, Mo., in the Current River. The project is rated as being capable of developing 8,000 hp.

Project No. 32.—Preliminary permit in favor of R. W. Hawley for a power development involving 60 hp. on Silver Creek, Eldorado County, Cal.

Project No. 52.—Preliminary permit in favor of the city of Dothan for a development involving 8,000 hp. at Chalkers Bluff, Geneva County, Ala., in the Choctawhatchee River. It was voted to reject the application of the Huston Power Company (Project No. 164) in conflict with the application of the city of Dothan.

Project No. 77.—License in favor of the Snow Water & Power Company for a development involving 15,000 hp. on the South Fork of Eel River in Lake County, Cal.

Project No. 78.—License in favor of the Western States Gas & Electric Company for a development involving the enlargement of an existing project of about 10,000 hp. on the American River in Eldorado County, Cal.

Project No. 166.—License in favor of the McConnellsville-Malta Electric Company covering an existing project involving 210 hp. located at U. S. dam No. 7 in the Muskingum River at Malta, Ohio.

Project Nos. 150, 180 and 181.—License in favor of the Pacific Gas & Electric Company covering transmission lines in Wapavai and Maricopa Counties, Arizona, and in Yuma, Nevada and Placer Counties, Cal.

Project No. 198.—License in favor of the Boston & Montana Milling & Power Company covering a transmission line in Beaver Head County, Mont.

Electrical Page Committee Formed in New England

UNDER the auspices of the New England Geographic Division of the National Electric Light Association an "electric page" committee has been organized with headquarters at Room 623, 149 Tremont Street, Boston. This committee, representing all branches of the industry, has been formed to promote concentrated advertising of electrical products and service in the newspaper press. L. D. Gibbs, Edison Electric Illuminating Company of Boston, is chairman of the committee, the other members being C. A. Andrews, Manchester (N. H.) Traction, Light & Power Company; E. L. Olds, Twin-State Gas & Electric Company, Boston; G. W. Hurn, Haverhill (Mass.) Electric Company; M. F. Falk, Union Electrical Supply Company, Providence, R. I.; L. L. Gaillard, New England Engineering Company, Waterbury, Conn.; W. F. Abely, Western Electric Company, Boston; M. R. Griffeth, General Electric Company, Boston; J. P. Coghlin, Coghlin Electric Company, Worcester, Mass.; William Gould, Gas & Electric Improvement Company, Boston; E. M. Graham, Bangor (Me.) Railway & Electric Company; Frederic Cutts, General Electric Company, New Haven, Conn., and H. S. Knowlton, New England editor ELECTRICAL WORLD, Cambridge, Mass.

Pennsylvania Electric Association to Meet Sept. 7-10

ANNOUNCEMENT is made this week that the Pennsylvania Electric Association will hold its annual convention at Bedford Springs, Pa., Sept. 7-10.

There will be morning and afternoon sessions except on Saturdays, when the final session will be held in the morning. The program opens on Wednesday evening with the reception to the president. On Thursday morning the chief features will be the address of the president, Henry Harris of Wilmerding; the appointment of auditing and nominating committees and a paper on "The Super-power Survey as It May Affect Pennsylvania" by Harold Goodwin, Jr. The afternoon session will be a commercial meeting with a number of

interesting reports and papers. The technical session will be held on Friday morning, while the accounting session will be held on the morning of Saturday. A feature of the entertainment will be nightly radio concerts furnished by the Westinghouse Electric & Manufacturing Company of Pittsburgh.

Prominent speakers will address the public policy session on the evening of Friday, Sept. 9.

Kva. Rather Than Kw. Demand Favored as Rate-Making Basis

A STRONG sentiment for the use of the kva. demand in place of the kw. demand on which to base rate schedules was manifest at the meeting of the Ohio Electric Light Association at Cedar Point on Wednesday, when the meter committee report presented by S. C. Henton was discussed. D. J. Angus discussed the two definitions for power factor that the American Institute of Electrical Engineers has had under consideration, pointing out that the first definition took into account the increased investment that would be required as a result of unbalance in the distribution circuits, while the definition that is known as No. 2 and favored as the proper one gives the same results whether the circuits are balanced or not. W. H. Pratt of Lynn, Mass., asserted that there are two conditions involved; one being the condition at the generating station on which the single-phase circuit, unbalanced because of the diversity as between customers, would have little effect, and the condition at the customers' premises because of the effect on the distribution conditions. The definition that seems preferable depended on the condition that was to be covered. R. C. Fryer of Cincinnati also emphasized the same matter and pointed out that the investment required to serve the consumer was one of the vital factors in rate making.

The address of President Hard at the first session of Tuesday afternoon emphasized the importance of the inductive interference and rural distribution problems. He recommended the formation of a committee to study the utility taxation problem. G. S. Merrill, for the illumination committee, laid stress on the necessity of selling light rather than electric light, showing that the day is past when electric light needs to be sold. The problem is now one of selling the proper and efficient use of lighting and educating the customer to the use of the proper amount of light.

Street lighting was discussed by D. L. Gaskill, who presented an analysis of the legal phases of the street lighting situation in Ohio with some suggested forms of specifications, contracts and ordinances. J. C. Martin of Columbus made a strong plea for street lighting rates that would return interest on the property involved in the service.

A review of the court decisions and an argument for the present-day basis of property values was presented in the paper by F. A. Newton of Jackson, Mich., on rate making. In the discussion J. C. Martin of Columbus called attention to the effect of a decision of the Ohio Supreme Court that in its practical effect prevents the inclusion of going value in a property valuation.

Live line maintenance received favorable discussion at the presentation of the report of the transmission and distribution committee, and the discussion also included a plea for standardization of line construction practices. The possibilities in reducing storeroom stocks of material were mentioned in the discussion. The annual banquet was held on Wednesday evening and the session continued over Thursday and Friday.

Secretary Hoover Discusses Our Need of Foreign Trade

"THERE is a feeling of some uneasiness and even of pessimism regarding the future of our foreign trade, in which I do not participate," said Herbert Hoover, Secretary of Commerce, in an address before the National Shoe and Leather Exposition and Style Show in Boston on July 12. Continuing, in part, he said: "Our exports and imports during the last few months have dropped nearly 50 per cent in value from the high water mark of a year ago. Some of this decrease is due to the fall in prices relatively more than volume; some of it to the temporary world depression, and some of it lies deeper.

"The direction of our trade has shifted greatly. During the last year about one-half of our whole foreign trade was with Europe, but of our exports to Europe 80 per cent were foodstuffs and raw material; of our exports to states outside of Europe about 75 per cent were manufactured goods. Europe in turn is our serious competitor in the marketing of our manufactured goods to the rest of the world.

"Another great but uncertain shift in world forces will arise out of Germany. Beyond the reparation payments of about $750,000,000 a year minimum, she must also sell goods abroad in the amounts necessary to buy her imports of food and raw materials. Any calculation based on the pre-war trade of Germany implies an enormous increase—perhaps more than doubling—of her pre-war exports. In view of the export duty and other payments, she must produce these goods for about one-half our production cost in order to take our markets. Such an increase in exports must be manufactured goods, and until the world consumption grows these must be marketed in the displacement of the goods of other industrial nations. We shall certainly feel the effects of this flow of goods that must be produced if she is to make reparation payments. On the other hand, Germany must take more raw materials from us for this purpose. In any event, the crowding in the market of German exports will affect her immediate neighbors more than ourselves.

"While establishing a proper equilibrium of imports and exports, if we would maintain our economic position, we must continue to give credits to buyers of our goods and if we should demand interest or principal on our established loans we would nullify any benefits of such credits.

Sells $500,000 Preferred to Customers in Twenty-two Days

AN EXTREMELY successful customer ownership campaign was completed July 8 by the Adirondack Power & Light Corporation, which sold $500,000 worth of 8 per cent preferred stock in twenty-two working days—with a considerable over-subscription. The issue was sold at low cost, entirely by company employees. Only a small amount of newspaper and direct-by-mail advertising was done. The campaign was under the supervision of Charles S. Ruffner, general manager, and the active direction of Percy H. Whiting.

Economy of Loading Coils on Telephone Circuits.—The great saving in telephone operation made possible by the use of loading coils was emphasized during one of the discussions at the Salt Lake City convention of the A. I. E. E., where it was brought out that in New York City alone $25,000,000 in investment and an annual charge of $4,000,000 had been saved by their use.

Electricity Supply in South Africa.—Following the example of Great Britain, steps are to be taken to reorganize and co-ordinate the electricity supply undertakings of South Africa. These include the passing of an act for unifying and modernizing the existing legislation governing the electricity supply in the various states of the South African Union, for the appointing of a controlling authority and for fixing standard voltages and frequencies. It is intended to adopt electric traction on some of the railroads, and a definite line of development to supply power for all purposes is the aim of those behind the movement. Existing electrical installations in South Africa are mainly owned and run by the municipal councils.

Pioneer New York Skyscraper Adopts Central-Station Service.—The Potter Building, at Park Row and Beekman Street, New York City, a twelve-story office structure which in its early days ranked among the skyscrapers, has recently abolished its lighting plant and its hydraulic elevator equipment in favor of New York Edison Company service. As part of the change, says the *Edison Monthly*, the high-pressure steam plant, with its three generators, pumps and other equipment, was moved. The four passenger elevators and the steam-operated sidewalk lift have been re-equipped so that they are now all electrically operated. The space gained by the abolition of the steam plant is now used as a storage vault. Frequent interruptions to the lighting service which had interfered with the tenants' satisfaction under the independent-plant system will now be over.

Water Power in Ireland.—A parliamentary committee which has been considering the water-power resources of Ireland has, according to the London *Electrician*, reported that 500,000 hp. is available continuously in that island and can be economically dveloped. The value of this power is put at £10,000,000 annually and is equivalent to the power generated by the annual consumption of 7,500,000 tons of coal. Detailed investigations which were made of the Lower Bann, the Lower Shannon, the Lower Erne and Liffey show that considerable power is available in these rivers as well as in the high-level lakes in Donegal, Connemara, Kerry and Wicklow. The committee urges that the work of developing Irish water-power sources be begun at once in the interests of fuel saving. Six hydro-electric stations on the Liffey are proposed, from which the power requirements of the Dublin district could be met.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Hydro-Electricity in the Holy Land.—According to a very roseate-hued estimate published in European papers, there is sufficient water power in Palestine for generating 1,000,000 electrical hp. An engineer interested in the plan for setting up a modern Jewish state in that country has recently outlined in the London *Times* a project to erect hydro-electric works for utilizing the water power of the Jordan and to build a dam at the southern end of the Sea of Galilee, where the main generating station would be established. The scheme would be carried out gradually as the demand for lighting and power increased.

West Penn Company Helps Sick and Wounded War Veterans.—By an arrangement with the West Penn Power Company, La Société des Quarante Hommes et Huit Chevaux, Voiture No. 5, Pittsburgh, has obtained an excellent summer camp site, rent free, with facilities for canoeing and bathing, on the Allegheny River near the company's new power plant at Springdale. While nominally for use of members of the society named, the camp will afford free outings to wounded World War veterans and other service men who have become incapacitated through illness and are quartered in hospitals in the Pittsburgh district. Three hundred were entertained on the formal opening day. The camp is complete with commissary, mess tent and sleeping tents.

Will Electricity Abolish the Farmer's Time-Honored Right to Grumble About the Weather?—A writer for the British Electrical Development Association, advocating a more general employment of electricity in farm work, expresses the perhaps overoptimistic view that on a farm completely equipped for electric service ground for the perennial complaints of the agriculturist against the weather would almost disappear, "owing to the fact that work can be done much more quickly in the preparation of the ground and cultivation. Moreover, protection can be afforded during the germinating, growing and maturing periods of the crops which protects them from adverse influences of the extremes of bad weather and conditions. At haymaking time the grass can be mowed in accordance with the original program, and then, if dark, threatening clouds spring up, the cut grass can be dried and made into hay by the aid of electric power, regardless of the absence of warm sunshine. Again, in harvesting, the increase of speed possible by electric methods is very advantageous, coupled with the fact that electrically operated binders can be used to cut even tangled crops."

Spiders, Rats and Vegetable Growths Make Trouble for Electrical Men.—Certain parts of South America, particularly Brazil, are, according to the United States Rubber Company, the habitat of an enormous spider that weaves its web around telephone wires strung on the cross-arms of poles. The web is spanned across several wires. It is heavy and of a thick texture. Until they discovered the source of the trouble the telephone companies were much perplexed when in the late evenings and nights frequent short circuits tied up their lines. When the sun is out the webs are dry and do no harm, but at night when the webs are covered with dew the trouble begins. The only remedy is the constant brushing away of the webs. On board ship trouble results when rats eat away the insulation on the electric wires. To meet the situation one manufacturer of wire mixes rat poison with a rubber compound that is used on the tape wound on the conductors. This scheme is said to be effective. In Porto Rico aërial plants attach themselves to the suspended telephone lines. These plants grow to large proportions and look like festoons hanging from the wires. The growths collect moisture and thus interrupt the service.

Associations and Societies

Engineers in Western Massachusetts Elect Officers.—Officers of the Engineering Society of Western Massachusetts have been elected as follows for the coming year: President, George E. Williamson of Mittineague; vice-presidents, C. B. Wheeler of Pittsfield and Frederic H. Fay of Boston; secretary and treasurer, Winfield E. Holmes of the Samuel M. Green Company, Springfield; directors for two years, George W. Atkinson of Springfield, Fred L. Hunt of Greenfield and F. F. Brand of Pittsfield; directors for one year, Alexis E. Trudo of Chicopee, Harry M. Chase of Holyoke and Edwin Krause of Springfield.

Coming Meetings of Electrical and Other Technical Societies

National Association of Electrical Contractors and Dealers—Buffalo, July 18-22. (For program see issue of April 30, page 1010.)

American Physical Society, Pacific Coast Section—Berkeley, Cal., Aug. 4 and 5.

Michigan Electric Light Association—Ottawa Beach, Mich., Aug. 24-25.

N. E. L. A., New England Division—New London, Conn., Sept. 6-9.

Pennsylvania Electric Association, Bedford Springs, Pa., Sept. 7-10.

N. E. L. A., Great Lakes Division—French Lick Springs, Ind., Sept. 14-16.

Association of Iron and Steel Electrical Engineers—Chicago, Sept. 19-24.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 20-23.

Illuminating Engineering Society—Rochester, N. Y., Sept. 26-30.

American Electrochemical Society—Lake Placid Club, N. Y., Sept. 29-Oct. 1.

American Electric Railway Association—Atlantic City, N. J., Oct. 3-7.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Segregation of Localities Into Group Units in Fixing Rates.—For the purpose of establishing just and reasonable electric rates for a utility serving several localities by means of transmission lines, localities of similar characteristics and size and served from the plant direct or the primary transmission lines are segregated by the Missouri Public Service Commission from those served by means of spurs from the primary lines, each group being treated as a unit for the purpose of establishing rates.

A Fair Permanent Return, Not a Fluctuating One, the Best.—Commenting on the rates asked for by a utility company which in 1919 and 1920 paid a dividend of 16 per cent on its common stock and for a period of seven years prior to Jan. 1, 1921, paid an average annual dividend of more than 13 per cent, the Public Service Commission of Connecticut observed: "It is a fundamental principle applicable to utility companies that the main reason for their existence is to furnish to the public a necessary service at reasonable rates, and not the accumulation of property and profits at the expense of the public. The financial hazard of a utility company falling upon the investors and the ultimate profits being limited by public regulation, the rate of return for the money honestly and economically invested should be liberal, to compensate for the risk taken, but the rate should not be based upon pyramided investment or inflated value of physical property. It is more important to the utility and to the public that the necessary capital invested and to be invested should be assured a fair permanent return than subject to fluctuating values and uncertain return, and the rate of return should be influenced by the market value of money at the time."

Setting Up a Contingency Reserve.—In a modification of a previous decision affecting the accrued depreciation of the Southern California Edison Company the California Railroad Commission ordered the company to set aside from its net earnings for 1920 a contingency reserve of $550,000, and that the contingency reserve to be hereafter accounted for should be limited to cover the fluctuations of water supply and fuel-oil price. An amount is to be credited to the contingency reserve each year which will represent the saving in fuel oil during the year resulting from the fact that the output from the company's hydro-electric plants during the year has been greater and the output from its steam plants has been less than would have been the case had conditions of water supply available to its hydro-electric plants been at average, together with an amount representing the saving to the company from any decrease below the standard of $2 per barrel at shipping points in the price paid by it for fuel oil consumed during the year. For opposite conditions a corresponding charge will be made against the contingency reserve, and the excess of credits over charges will constitute the fund. In determining the extent to which in any year the output from hydro-electric plants is greater or less by reason of the water supply conditions of that year being greater or less than average, the load of the year under consideration will be applied to the water resources of each of the years for which an adequate record exists, taking into consideration both the hydro-electric installation available during the year under consideration to utilize such water resources and the steam capacities to supply the balance, and the average of such figures will be taken as the output under prevailing water conditions.

Principles Governing Dual Service.—Holding that the test of confiscatory rates in a combined electric and steam-heating utility is whether the particular service sustains itself, and that rates should not be higher in either of two combined services rendered by a public utility than the value of that service to the public standing alone, the Montana Public Service Commission denied the application of the Eastern Montana Light & Power Company for an increase of electric rates at Glendive until such time as a proper segregation and allocation should be made. It said: "While rates may not be so low as to deprive an owner of a fair return on the fair value of his property devoted to the public service, it is a principle of equal dignity and importance, and constantly opposing, or tending to oppose, that rates may not be higher than the value of the service to the public. Here are two utilities operated by one corporation, and doubtless there are consumers of light and power who do not use steam heat and vice versa. Of what value then is the steam heat service to the straight electrical users? Obviously, of no direct value. Would any one suggest that the consumers of steam heat only should should help pay for the electrical energy used by those who demand only the electric service? And yet if it is shown that the steam-heat service is not self-sustaining, but that it is in fact leaning on the electric utility, which is paying a fair return on the combined investment for the two utilities, are not the electric consumers, despite the fact that they never use a pound of steam heat, helping to pay for the heat consumed by those who patronize the steam-heating utility alone? What, then, becomes of the principle that consumers of a public service should not be required to pay more for such service than the sum which it is reasonably worth?"

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Oiler Injured in Bus Room, Where He Had No Right to Be, Cannot Recover.—A workman employed as a night oiler of machinery in an electrical power house, whose sole duties were to oil certain engines and pumps in one part of the building, but who without proper cause left his work and entered the bus room, where he was injured by contact with electrical appliances occasioned by his own recklessness or carelessness, cannot recover damages under the workmen's compensation act of Kansas, according to the decision of the Supreme Court of that state in Haas vs. Kansas City Light & Power Company, his injuries not arising out of and in cause of employment. (198 Pac. 174.)*

Powers of Oklahoma Supreme Court in Appeals from Commission Decisions.—In hearing an appeal which was made by the St. Louis-San Francisco Railway Company against rates fixed by the State Corporation Commission of Oklahoma, the Supreme Court of that state, asserting that the order of the commission must be regarded as prima facie just and correct, nevertheless declared it to be the duty of the court to try the case de novo upon the record and evidence introduced before the commission and judicially to determine and fix a new rate if in its opinion the evidence submitted upset the prima facie presumption referred to. (198 Pac. 73.)

Meaning of "Adequate Consideration."—In United States Smelting, Refining & Milling Company vs. Utah Power & Light Company, the Supreme Court of Utah affirmed an order of the Public Utilities Commission of Utah which altered the contract rates for electricity purchased by the plaintiff from the defendant. The smelting company in contesting the commission's order relied on a provision in the public utilities act of Utah to the effect that nothing in the act shall prevent the carrying out of contracts for public utility service previously made and founded upon adequate consideration." The court found that the consideration in the contract at issue was not adequate, declaring that by "adequate consideration" was meant such consideration as, when all the elements which enter into the transaction are considered, would prevent the beneficiary under the contract from receiving a substantial preference or advantage over the public or other utility in the matter of rates or charges for the service rendered. (197 Pac. 902.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

R. C. McFadden, who has been appointed district manager of the Southern California Edison Company at Oxnard, Cal., as recently announced in ELECTRICAL WORLD, was born at Placentia, Cal., in 1887. Upon completing his course in electrical engineering at Stanford University in 1910 he was employed by the Tacoma (Wash.) Railway & Power Company, one of the Stone & Webster properties. He remained with the Stone & Webster organization until 1916, when he entered the commercial department of the Pacific Light & Power Corporation of Los Angeles, giving special attention to the development of that company's electric range and water-heater load. Following the consolidation of that company and the Southern California Edison Company in 1917 Mr. McFadden was transferred to Ventura, where his duties were enlarged to include the development of the power load in that territory. During the war he enlisted in the naval service and was discharged with an ensign's commission. On his return he was sent to Long Beach on power-sales work. He was later made acting manager in that district, a position he held up to his appointment as district manager the first of this year.

R. C. MC FADDEN

Fred B. Johnson, who recently retired from the Indiana Public Service Commission, has taken up the practice of utility law.

John J. Caddigan, for the last two years assistant superintendent of the advertising department of the Edison Electric Illuminating Company of Boston, has been appointed an assistant to the general superintendent. Mr. Caddigan has been assigned to the duty of promoting closer co-operation throughout the various branches of the electrical industry in the Boston Edison territory, including active personal contact with central-station jobbing and contractor-dealer interests.

Miss Sarah Mary Sheridan, who was recently elected a vice-president of the Detroit Edison Company, came into the electric light and power industry in the '90s, when the pioneer technical work had been done and commercial development was beginning to take its modern form. For several years she has been sales manager for the Detroit company, which enjoys not only one of the most rapidly growing loads in the country but one of the most diversified as well. Beginning work as the youngest employee in a total list of less than fifty, Miss Sheridan is now an officer of an organization of nearly 5,000, of whom, on the day of her recent promotion, 569 were reporting to her. In her earlier work she learned all the ways and methods of dealing with customers and also learned the personalities and methods—or lack of methods—of customers themselves, individually and in the aggregate. Her opportunity came in 1904, when she was inquiry and record clerk of the small sales organization of the Detroit Edison Company. That organization was even then differentiated into lighting and power divisions, into inquiry and record divisions, and had its competent sales engineers and estimators. The illness of the officer who had charge of sales made it necessary to appoint an acting chief for twelve months in his place, and Miss Sheridan secured the temporary appointment. From the start she showed that she was a natural executive, and that she had exceptional ability to gain and hold the loyalty of her staff, and the goodwill and the respect of all her customers. From that time on her success came with opportunity and she grew with a growing concern in a prosperous town. She has always been willing to assume responsibility and has the gift of making quick decisions correctly.

MISS S. M. SHERIDAN

Charles W. Tippy, general manager of the Consumers' Power Company, Jackson, Mich., was recently elected vice-president of the company. Mr. Tippy began to work for utilities when a boy. All of his early experience, however, was in the gas-supply field, and it was not until 1912, when he went to Detroit as assistant to W. M. Eaton in the management of the electric properties of Hodenpyl, Hardy & Company in Michigan, that he became associated with electric light and power service. In 1914 he went to Jackson as general manager of the Consumers Power Company, at the time this company passed from a holding company to an operating company in Michigan. Mr. Tippy was born in Three Oaks, Mich., in 1876 and was graduated in 1899 from Purdue University, where he took the mechanical engineering course.

C. W. TIPPY

F. D. Brown, for eight years manager of the Huron (S. D.) Light & Power Company, has resigned, to open an engineering office in Huron. Mr. Brown will be succeeded by J. A. Ward of Chicago.

Walter A. Shaw, special technical expert, has been engaged by the Board of Public Utility Commissioners, New Jersey, to assist the commission in special rate hearings. Mr. Shaw was formerly connected with the Illinois Public Utility Commission.

M. J. Maxfield has been appointed director of laboratory instruction, department of industrial electrical engineering of Pratt Institute, Brooklyn, N.

Y. Mr. Maxfield was formerly connected with the department of electrical engineering of the Pennsylvania State College.

Charles L. Towne has been appointed resident manager of the department of information of the Georgia Railway & Power Company, Atlanta. This department will be under the direction of Ivy L. Lee.

Ralph D. Ballew has been appointed city manager of Sturgis, Mich., effective May 15. Mr. Ballew was formerly manager of the Grand Rapids branch of the Westinghouse Electric & Manufacturing Company.

Chester M. Clark, formerly head of the corporation department of Stone & Webster, Inc., has been elected treasurer of Arthur D. Little, Inc., chemists, engineers and managers, Cambridge, Mass.

Merton R. Sumner has been appointed chief engineer of Arthur D. Little, Inc., chemists, engineers and managers, Cambridge, Mass. Mr. Sumner was formerly chief engineer of the Fuller Industrial Engineering Corporation.

David C. Rosetahl has been appointed general sales manager of the Robert Findlay Manufacturing Company, Brooklyn, N. Y. Mr. Rosetahl was formerly associated with the B. & K. Manufacturing Company, New Haven, Conn.

Edward R. Knowles, a well-known consulting engineer and fuel expert, has recently become associated with the engineering firm of Murrie & Company, Inc., of New York City. Mr. Knowles will have charge of the company's pulverized-coal and gas-fuel engineering work.

F. E. L. Whitesell, who for several years has been connected with the sales department of the Railway & Industrial Engineering Company of Greensburg, Pa., has been appointed New England representative of the company, with headquarters at 136 Federal Street, Boston. Mr. Whitesell is a graduate of Washington and Jefferson College and during the world war served with the ambulance corps in France.

G. W. Borst, who for the past eight years has been electrical engineer for the Chicago Fuse Manufacturing Company, has resigned and will take a rest until about Sept. 1. His plans from then on have not as yet been definitely formulated. Mr. Borst is an electrical engineering graduate of the Armour Institute of Technology. After receiving his degree, he spent several years with the Westinghouse Electric & Manufacturing Company in the main factory, various branches of the engineering department and on outside erection work. In 1910 he became connected with the Western Electric Company, where he remained for three years, leaving in 1913 to join the Chicago Fuse Manufacturing Company. In the latter position his principal duties were along the lines of fuse development, but his duties also covered work on factory costs, estimating and advertising. He also was active in outlet-box standardization.

H. W. Stortz, formerly with the Transportation Engineering Corporation of New York and the Edison Storage Battery Company of Orange, N. J., is now New York district manager of the American Radio & Research Corporation in charge of motor and radio equipment sales, with offices at 21 Park Row.

Maxwell Alpern, president-elect of the Stoker Manufacturers' Association, is vice-president and general manager

MAXWELL ALPERN

of the American Engineering Company, Philadelphia. He was born in Alpena, Mich., in 1884 and was graduated in engineering from the University of Michigan in 1906. Mr. Alpern is a specialist in combustion engineering and is the inventor of one of the well-known mechanical stokers.

Allan V. Garratt, formerly chief engineer Lombard Governor Company, and lately consulting engineer hydraulic department Lockwood, Greene & Company, Boston, has established an office at 176 Federal Street, Boston, Mass., for the practice of hydraulic engineering along consulting and advisory lines.

Charles W. McKay, until recently president of McKay & Sherman of Chicago, has become identified with the American Appraisal Company, Milwaukee.

Robert Johnson has recently been appointed district manager of the Oakland (Cal.) office of the Federal Electric Company. Mr. Johnson has had a varied experience in saleswork. For four years he was salesman for the Commonwealth Edison Company of Chicago. The next three years were spent as contract agent for the Milwaukee Electric Railway & Light Company. The next four years were divided evenly between the H. W. Johns-Manville Company as salesman in Milwaukee and the Utah Power & Light Company as commercial salesman in Salt Lake City. Mr. Johnson left this post to join the Federal Electric Company as its Intermountain representative in 1912. From there he was promoted to his present position.

I. H. Lovett has received the appointment of assistant professor of electrical engineering at the University of Missouri, Rolla, Mo. In 1914 he was graduated in electrical engineering at the Massachusetts Institute of Technology. For five years he was employed in the engineering department of the New England Power Company. Recently he has been an instructor in electrical engineering at the Worcester (Mass.) Polytechnic Institute, which position he leaves to begin his new work.

Eustace C. Soares, now electrical engineer of Ophuls, Hill & McCreery, Inc., has had a varied experience with manufacturing and central-station companies. He was born in Port Royal, Jamaica, British West Indies, Sept. 20, 1889. Coming to America in April, 1908, he entered the employ of an automobile manufacturer, after which he was employed by the Brooklyn Edison Company and the United Electric Light & Power Company in operating capacities. During these years he studied electrical engineering with the American School of Correspondence and at Cooper Union. His next position was with the Crocker-Wheeler Company, where for two and a half years he was in charge of the department which tests all the apparatus manufactured by the company. He also supervised electrical maintenance and for a while had charge of the repair department.

Obituary

John Findley Wallace, chairman of the Chicago Railway Terminal Commission, recently died in Washington, where he was attending Interstate Commerce Commission hearings. Mr. Wallace, who had been engaged in engineering for the past fifty years, for more than ten years directed the activities of Westinghouse, Church, Kerr & Company, which more recently has been merged into the Dwight P. Robinson engineering organization. He became chairman of Westinghouse, Church, Kerr in 1906, and later became president as well.

Achille Fournier, director-general of the French works of Schneider & Company, one of the leading industrial firms of Europe, was killed last month in France when a motor car in which he was riding was struck by an express train. Although only thirty-eight years old, Mr. Fournier had played a leading part in industrial production both under war-time conditions and since the re-establishment of peace. He was especially interested in the development of hydro-electricity and the electrification of railroads in France and contributed to these projects the powerful help of the Schneider works.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

$18,560,000 in Electrical Porcelain Made in 1920 in U. S.

THE United States Geological Survey, in its review of the pottery industry in the United States in 1920, shows that the value of pottery produced in the United States in 1920 was $105,700,000, of which $18,560,000 went into porcelain electrical supplies. This figure of porcelain electrical supplies for the year 1919 is estimated by the Geological Survey at $12,190,000, so that the 1920 production is more than $6,000,000 better than that of the year before, or about 52 per cent.

"Notwithstanding the great demand and the large value of the output," says the Survey, "the potters had many handicaps, chief among which were the shortage of fuel, especially in the western districts, and the shortage of materials on account of transportation difficulties, both of which caused considerable loss in production, and it was well toward the middle of the year before anything like normal conditions prevailed in regard to fuel and transportation. The refusal of operatives to work full time and the decrease in output per man were further handicaps which it was impossible to overcome.

"There were no general strikes in the industry, but the few minor ones that occurred were sufficient to cause serious loss in production."

Ohio Manufacturers Reported on Better Working Schedule

MANAGERS of power plants throughout Ohio have noted considerable revival in the activities of manufacturing companies, according to the report of D. L. Gaskill, secretary-treasurer of the Ohio Electric Light Association, who, while in Toledo recently, said, while talking with President Frank R. Coates, of the Toledo Railways & Light Company: "Power plants of the state are a good indicator of business. The load of power that is carried directly measures manufacturing and tells what the heart of business is registering.

"Ohio was hardest hit at Akron, where the power load fell off more than 65 per cent. But even though Akron is a one-industry city it is coming back, and power is being turned on in most of the plants. Other Ohio cities are showing steady gains. I believe it will be at least a year, however, before we are back to a real normal basis again."

Ventilating Equipment Sales Hold Up in Good Volume

ONE of the most active lines of electrical equipment and apparatus just now is that of ventilating, fan and blower equipment. Although sales of the ordinary desk fans were disappointing up to the middle of June, the hot weather of the latter part of that month started a very encouraging movement. Ventilating equipment, though, had been moving well and just now is gaining a good momentum. Certain manufacturers are working their plants at full time, but in several other cases this rate has not been reached and will not be reached, they say, till commercial and industrial building sets in in earnest.

Air conditioning in food-manufacturing establishments, textile, woodworking and many other classes of industries, as well as in power-plant work, is receiving general consideration, and the outlook in that direction is very encouraging. Old plants, too, are being equipped with ventilating systems. Considerable stress is being placed on direct-connected fan and blower sets for ventilating restaurants, garages, dyeing and laundry establishments and for kitchen and furnace use in the home, and special efforts in this direction are getting results.

Some producers are making for stock, and in general shipments can be made at short notice. Hardly over a week is needed to fill an order for manufacturing. Sheet metals, castings, angle iron, etc., are lower in price than they were the first of the year, and some price revisions have consequently been made. Of course, motors and control are lower, besides wiring materials.

Extraordinary Demand for Fans in Minneapolis Center

CONTINUANCE of the hot spell throughout the country has brought new local records in fan sales, an interesting example of which is from the district surrounding Minneapolis and St. Paul. Here the fan season is often as short as ten days but usually divided into three short periods, one early, one in July and one in August. This year the temperature has been in the nineties during the daytime and with only a five to ten-degree drop at night since June 1. Stocks of fans were exhausted two weeks ago and rush orders are now being filled by express from Eastern points. These are in small lots and are promptly exhausted by standing orders.

In the Twin Cities and the surrounding territory two jobbers have already sold more than five thousand fans. In the city of Minneapolis alone about four thousand have been sold. These have come from every available source including jobbers, dealers, hardware stores, plumbing stores and machinery second-hand dealers. It is conservatively estimated after a careful check of the demand that more than ten thousand fans could have been disposed of in that city had the stock been available. Jobbers report that the 9-inch fan is the most popular size when price alone is considered and the 12-inch and 16-inch oscillating under other circumstances.

Weatherproof Wire Sales Making Slight Progress

CENTRAL station extensions are not making very noticeable inroads on jobbers', distributers' and manufacturers' stocks of weather-proof wire. There is some central station buying in the Chicago territory, the southeastern states find sales holding up pretty well on Nos. 6, 8, 10 and 12 and the St. Louis district is finding a slightly increased demand for weather-proof wire in sizes Nos. 6 and 8. There some of the jobbers are buying to keep their stocks on an even level. New England reports show a decided change for the better as the number of building permits and of contracts for wiring old houses is increasing favorably, calling for line extensions. New York territory is not noticeable in its purchasing.

Still there has been considerable residence building in the Northwest, southern California, the Intermountain district, the Southeast, in some parts of the New York territory and in parts of New England, and this should encourage sales of weather-proof for street extensions out-

side of congested city districts. But electric railway buying and central-station buying as a whole has been so quiet the weatherproof wire mills are running at a rate of about 50 per cent only. Shipments naturally are good and stocks are still too high for mill comfort. With bare copper wire quoted at 15-15.25 cents bare at the mill, up-river fine para rubber at 15½ cents, first latex crepe at 14¾ cents and spot cotton in New York at 12.70 cents, weatherproof wire can be purchased at a relatively low rate, about a 16½-cent base ruling for No. 6.

Lower Steel Prices Bring Conduit and Other Products Down

FOLLOWING general reductions in the price of steel products that were made recently, lower quotations have resulted on a number of electrical steel products. Effective July 7 the U. S. Steel Corporation reduced the price of standard steel pipe from the discounts shown on its April 13 card as follows: ¼-in. and ⅜-in., 1 point or $2 per ton; ½-in. to 6-in., 2 points or $4 per ton; and 7-in. to 12-in., 3 points or $6 per ton. Effective July 11 a number of the leading manufacturers of electrical conduit also reduced prices by increasing the discount allowed distributers, at the same time advancing the number of their base card by one. The decrease amounted to 9 points on black and galvanized conduit in some instances and 5 points in others. The difference of 4 points is accounted for by earlier price reductions on the part of those who at this time dropped the least, so that base prices are said to be approximately on the same level. Sizable stocks are reported by manufacturers, with keen competition for orders and generally quiet conditions of demand. The new card is No. 47, the discount on ½-in. black in carload lots being 41 per cent and on white 35 per cent.

In line with the drop in the price of base sheets, outlet box quotations have been generally reduced 11 per cent on black and 10 per cent on galvanized. The drop became effective on various dates ranging from June 27 to July 11.

Locknuts and bushings were reduced approximately 29 per cent by manufacturers during the same period as the outlet box price decrease noted above. The discount to jobbers in standard packages was increased 10 points.

Switch box prices are also down, the drop in several instances there becoming effective around the first of the month. The amount of the decrease varied with different manufacturers, ranging from 11 to 35 per cent.

The Straits Settlements as an Electrical Market

EXPORTS of electrical materials and apparatus from the United States to the Straits Settlements during the year 1920 amounted to $283,104. This figure and those in the table below were compiled by the ELECTRICAL WORLD from data received from the Bureau of Foreign and Domestic Commerce. From this table it is interesting to note that exports of batteries and of magnetos, spark plugs, etc., amounted to $111,036, more than one-third of the total electrical exports that year.

STRAITS SETTLEMENTS

	1920 Exports
Batteries	$65,119
Cazbons	3,906
Dynamos and generators	26,415
Fans	17,009
Insulated wire and cable	11,516
Interior wiring supplies (including fixtures)	7,397
Metal filament lamps	4,397
Magnetos, spark plugs, etc	45,917
Meters and measuring instruments	4,023
Motors	21,543
Switches and accessories	3,797
All other	72,065
Total	$285,104

Receipts of dynamos and generators came next highest, with motors closely behind. Fans showed relatively high receipts. None of the items of a general electrical nature rate very high in the Straits Settlements, but it is reasonable to believe that there will be an increasing market for electrical materials. Tin, of course, is the well-known products of these Settlements, but spices, rubber, rattan, coffee, gum, sago and copra are also widely exported from there. Consequently a modernizing of these industries should provide a further outlet for electrical supplies. At the same time a large transient trade is handled by the principal ports, which are Singapore, Georgetown and Malacca.

Exports for the first four months of this year have amounted to $90,850, which is virtually one-third of last year's total. This year to date, however, is going at a rate exceeding last year's figures in dynamos and generators, fans, heating and cooking appliances, interior wiring supplies, metal filament lamps and transformers while the other listed items are falling behind.

The *Electrical Times*, London, shows that in the years 1917, 1918 and 1919 the British Malaya drew its electrical supplies from countries as follows:

	1917	1918	1919
United States	£17,293	£9,179	£74,593
United Kingdom	28,569	17,028	50,430
French India	.....	.....	16,643
China	422	7,674	4,651
Australia	796	792	1,074
Italy	1,753	933	857
Japan	8,195	13,806	811
Hongkong	1,231	1,688	592

Switch Box Section A. M. E. S.

IN AN item appearing in these columns of June 25 the ELECTRICAL WORLD was advised that in the formation of the Switch Box Section as part of the Outlet Box Section of the Associated Manufacturers of Electrical Supplies, F. H. Merrill, of the Appleton Electric Company, was chairman. Recent advices, however, show that W. W. Merrill, vice-president of the Chicago Fuse Manufacturing Company, is chairman of the Switch Box Section.

The Metal Market Situation

PRODUCERS of copper still hold for 13 cents a pound delivered, but some of them are reported to have accepted ¼ cent lower than that for prompt shipment. Small interests have even taken as low as 12.62½ cents for prompt copper though the quoted range is 12.75 to 13 cents for July and August. Further ahead than that there is little interest shown. Domestic demand is as light as ever but there is greater activity in export sales.

To assist in financing the exportation of 500 tons of copper to Italy the War Finance Corporation has agreed to make an advance of $145,000 to an American banking concern. The outside market is dull, for there is little copper held by second hands and prices are slightly higher than producers'.

Zinc shows little change with demand light and prices steady. Inquiries for lead are reported to be good and the market is firm. Sterling exchange has dropped to the extremely low figure of $3.62¾ at present and the price of tin has reacted by falling to 28.37½ cents.

NEW YORK METAL MARKET PRICE

	July 5, 1921	July 12, 1921
Copper	£ s d	£ s d
London, standard spot	72 5 0	72 0 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00	12.87½—13.00
Electrolytic	12.87½—13.00	12.75—13.00
Casting	11.75—11.87½	11.75—11.87½
Wire base	15.00—15.25	15.00—15.25
Lead, trust price	4.40	4.40
Antimony	4.75	4.65
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Zinc, spot	4.85	4.80
Tin	29.87½	28.37½
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.25—9.50	9.50—9.75
Brass, heavy	4.25—4.50	4.25—4.50
Brass, light	3.50—3.75	3.50—3.75
Lead, heavy	3.25—3.50	3.37½—3.50
Zinc, old scrap	2.00—2.25	2.00—2.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

OF ALL the electrical supply buying this week, fans hold the front stage. Ideal fan weather has prevailed all over the country and movement has been very satisfactory. Trade in general is spotty to quiet. In New England house wiring is good, building permits are increasing and line extensions are more frequent. Fundamental banking conditions are better. Building is a little better in the Metropolitan district too. There is improvement in agricultural outlook in the Southern states, there is more money in circulation and electrical buying is better in agricultural regions.

Chicago is quiet in electrical trade but has some street lighting activity by several municipalities. Building is hesitating still. Further south buying is more cautious than a month ago but there is a fair movement of pole-line materials and accessories. Home building continues on a good volume in the Intermountain district. In the Northwest export trade is reviving; home building is very active in Portland but only fair in Seattle. Northern California is still in the grip of a building strike but the southern part of the state is active. Collections generally show no improvement.

Following steel pipe and sheet reductions at the mills, electrical manufacturers have reduced conduit, outlet boxes, switch boxes and locknuts and bushings.

NEW YORK

Activity in the general electrical market continues on the same quiet plane as heretofore, but the rush with which fans are selling helps to balance dullness in other lines and makes things seem brighter. Industrial demand shows very little if any improvement, it is stated, and there is not much buying on account of building work. Sales to dealers and contractors seem to be about the largest class of business at present.

Collections are getting neither worse nor better but are about holding their own, and the trend among jobbers is still to liquidate rather than to buy. Recently announced reductions in steel quotations have resulted in price decreases on several electrical items including conduit, outlet boxes, locknuts and bushings and switch boxes.

A large building operation involving about $1,500,000 has been started at Jamaica, L. I., which will include store and office buildings, a public market and manufacturing plants. Building contracts for New York State and Northern New Jersey awarded in June amounted to $62,659,000, an increase over May of 8 per cent, which again was 14 per cent ahead of April according to the Dodge reports. Of the June total 54 per cent was for residential work. In the Middle Atlantic States, however, the total June building contracts of $32,136,000 represented a 27 per cent decrease from May.

Locknuts and Bushings.—Manufacturers have generally reduced prices about 28 per cent by increasing the discount allowed on standard packages 10 points.

Outlet Boxes.—Virtually all manufacturers have increased the discount allowed on both black and galvanized boxes by 5 points, making a cut of about 10 per cent.

Switch Boxes.—Prices have been reduced but not uniformly. One manufacturer has made a cut ranging from about 11 to 17 per cent, another from 17 to 26 per cent and a third from 27 to 35 per cent.

Rubber Covered Wire.—Conditions are unchanged; No. 14 single braid holding at $6.50 to $7 per 1,000 ft. in 10,000 ft. lots, with demand poor and stocks good.

Flexible Armored Conductor.—The current market is weak with plenty of material on hand; No. 14, two-wire, double and single-strip is bringing $53 to $55 per 1,000 ft.

Fans.—One or two jobbers still report disappointing sales but the majority are in the midst of an unprecedented rush to fill orders. Ideal fan weather has been experienced and several jobbers have sent in repeat orders. Sixteen-inch and 12-in. oscillators stand out in the buying. Some ceiling fans are moving but not a great lot, while sales of exhaust fans are slow.

Flashlights.—Demand is spotty among different jobbers, though some report a good volume of vacation buying. Renewal sales are only fair. Stocks are well filled with prices steady.

Loom.—In 1,000-ft. lots $\frac{7}{32}$ in. brings $20 to $24.80 and $\frac{1}{4}$ in. from $24 to $27 per 1,000 ft. Good quantities are on hand but demand is small.

Lamp Cord.—No. 18 cotton twisted brings $12.50 to $14.50 per 1,000 ft. in that quantity and No. 18 cotton parallel from $15 to $17.50, but the good stocks held are not moving.

CHICAGO

The only activity of note in the electrical industry during the past week has been the purchase of materials for ornamental street lighting by several different municipalities. It seems that the only buying power in evidence at present is that of the taxing powers. Purchases in all other lines are limited strictly to routine requirements and the most radical efforts to induce heavy buying on the part of the general public meet with an almost total lack of response.

The building industry remains stagnant as the arbitrator has so far failed to render a decision. All work under way is proceeding, but no new projects are being initiated.

Collections remain as slow as before and no price changes in electrical goods are noted.

Motors.—What little demand there is is limited to small lots for replacement purposes. Although various small concerns are offering motors "new or as good as new" at very low figures, all established lists are firmly held by the larger concerns.

Fractional Motors.—Manufacturers are proceeding on very conservative lines as the consumption by makers of washing machines, vacuum cleaners, etc., is thought to be over 40 per cent of normal. As in the case of larger motors, lists are firmly held, the current price of a $\frac{1}{4}$-hp., 1,800 r.p.m., alternating-current motor being quoted by one jobber as $28, list.

Fans.—Four weeks of excessive heat with no relief in sight has stimulated the best fan business in three years. Jobbers find it impossible to meet the demand, back orders in some cases running into the thousands. Prices are firm, with the heaviest demand being noted for the 10-in. size.

Exhaust Fans.—The same conditions which are boosting the sale of desk fans are helping distribution of exhaust fans. Demand is notably better than that of a month ago, although supplies are having no difficulty in filling orders. A 24-in. single-phase fan is quoted at $189, list.

Ornamental Street Lighting.—Poor retail business in all sections is causing retailers to strive for "business getters." This is finding expression in numerous requests for information as to the cost of installations and in the actual placing of orders for several lots ranging from 50 to 500 poles. Deliveries are being promised in good time.

Farm Electric Plants.—The summer bids fair to pass with but little business closed. Dealers are wholly unable to accept their full quota and factories are operating on greatly reduced schedules. No price changes are recorded.

Bare and Insulated Copper Wire.—No price changes of moment have been reported and sales are at a minimum. Copper wire, No. 8, bare, remains at 17 cents per lb. in 1,000-lb. lots; rubber-covered, No. 14, is $7 per 1,000 ft. in 10,000-ft. lots; weather-proof, No. 6, triple braid, is 18½ cents per lb. in 1,000-lb. lots.

BOSTON

Trade continues spotty in this district. The principal market for electrical material is the central station and the contractor dealer at the moment. Wiring of unwired houses is fairly active and the demand for line extensions is increasing. Metal industries are quieter than textiles and the woolen industries are operating at 75 per cent of capacity or over. Boot and shoe plants are running at about 50 per cent of capacity. Retail sales, indicated by the department store reports to the Federal Reserve Bank, are holding up finely. Collections are unimproved in the electrical field. Jobbers' stocks are still being liquidated and buying is largely on a hand-to-mouth basis. Building and engineering contracts, however, for the week ended July 5 in New England totaled $6,262,800, a figure equaled only in two of the past twenty-one years, according to the Dodge reports, and comparing with $4,196,900 for the preceding week. Fundamental banking conditions in New England are better. Prices weakened this week about 10 per cent on rigid conduit and on some porcelain material.

Fans.—Last week's extreme weather pulled hard on retail stocks but did not exhaust distributers' supplies of fans. Excellent sales are reported from electric stores.

Wire.—Central-station buying featured last week's weatherproof market, orders aggregating about $350,000 being reported from several of the larger companies. Base price, Monday, 16 cents. Rubber-covered No. 14 wire was selling Monday at $9 per 1,000 ft. in coil lots and from $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots. Stocks are good.

Porcelain Fittings.—A drop of about 10 per cent on tubes and other fittings except "Nail-it" knobs was announced Monday. The latter sold at $21 per 1,000 in barrel lots and at $18 in three-barrel lots. Some activity is apparent in the insulator market.

Rigid Conduit.—Following a further drop in the price of steel, rigid conduit softened Monday at Boston about 10 per cent. The current price of 1-in. black pipe was approximately $105 per 1,000 ft. and of galvanized about $115 in lots under 5,000 pounds.

Washing Machines.—With good local stocks, distributers are preparing for an active demand a little later in the season. A leading distributer is selling about three carloads per month at present in two makes, but midsummer is a quiet time for the sale of the larger appliances.

Flexible Armored Conductor.—Moderate sales are being handled and about $55 was being charged per 1,000 ft. in lots of 1,000 to 2,500 ft. the first of this week in No. 14 double-strip. Stocks are easily meeting the demand.

Portable Lamps.—A reasonably good season is being enjoyed in such sales. One prominent retailer exceeded his first half 1920 portable sales this year and a still better demand is expected later.

Irons.—These are moving well and vigorous campaigns are yielding good results. Older types at reduced prices are moving exceedingly well.

Meters.—Business is not brisk, but wiring work is absorbing a good many meters from week to week. One active central station added 42 per cent more meters this year to June 30 than for the same part of 1920 in old-house wiring.

ATLANTA

Despite the interference of holidays the first week in July has shown signs of continuing the activities of the prior month, and while the fan business which has been induced by the extraordinary hot weather approximates 60 per cent of the total business, at the same time there is a fairly steady demand for electrical goods in general, particularly in the class of construction material. This class is going mostly to the larger cities and to middle Georgia, where the excellent peach and melon crops have placed considerable amounts of money in circulation. Agricultural reports indicate a good yield in all of middle and south Georgia, particularly in the food crop line, while the cotton is reported as being slightly above the estimate of two weeks ago. This is resulting in a better feeling for the business outlook in the smaller towns this fall.

Panelboards.—One of the larger manufacturers announced a reduction in price of approximately 10 per cent in this line, and stocks are moving fairly satisfactorily. Drop shipments from factory are reported very prompt.

Schedule Material.—On the recent reduction in price contractors and dealers are replenishing depleted stocks and it is expected this line will continues to show activity for another ten days. Sockets, porcelain tubes and Nail-it knobs are moving particularly well. Jobbers' stocks are reported in good condition.

Rigid Conduit.—There is a slight variation noted in price in this line as some manufacturers have made sharper cuts than others. Both black and galvanized in ½-in., ¾-in. and 2-in. sizes are moving very well in less than carload lots, but sales of large quantities are rather slow. Local stocks are from good to heavy.

Tape.—A continued steady demand is reported for black friction, but the demand for varnished cambric is dull. Rubber tape, however, continues to keep pace with the friction. Only fair stocks are reported on hand.

Flexible Armored Conductor.—The brisk movement of the past two weeks has largely disappeared because the price has again risen to $67.50 per 1,000 ft. and contractors are stocked up at a lower figure.

Fuses.—Plug fuses are reported at $3.57 per 100, but this price reduction has not served to stimulate buying, though a slow movement continues. Renewable cartridge fuses are selling well to those custmers who have had experience with them. Stocks of both types are in excellent shape.

Pole Line Hardware.—Despite the excellent prospects and the receipt of large numbers of inquiries, little or no heavy bona fide orders are being placed. Jobbers state, however, that they expect a satisfactory movement of the entire line before Sept. 1.

Farm-Lighting Outfits.—Sales are reported rather spotty, but prospects for purchases from the rural districts in middle and south Georgia are very bright and manufacturers report the placing of a very satisfactory number of sets in this locality during the past two weeks.

ST. LOUIS

The week shows no marked change in general business or in that of the jobbers. Every one is buying more cautiously than a month or so ago and dealers are endeavoring to maintain their stocks at the absolute minimum consistent with the immediate needs.

Except for the seasonal purchasing of appliances such as fans, the most active field appears to be in plant and distribution extensions of municipalities and the smaller utilities. Fairly good movement is found in pole-line materials, distribution transformers, lightning arresters, generators and switchboards. As a rule the orders are not individually large, but a goodly number keep coming in.

The cost of building is being closely watched for its effect upon the electrical industry. Wage agreements in some lines have expired and the contractors are endeavoring to obtain reductions in all lines; the State is investigating the activities of the St. Louis Millmen's Association, the St. Louis Material Dealers' Association and the Lumber Trade Exchange.

The number of unemployed in St. Louis was 0.4 per cent more in June than in May, according to reports of the United States Department of Labor. There has been greater decrease in those employed industrially, but this was offset by the customary exodus to the harvest fields.

Dry Cells.—A good and steady demand continues over the entire territory and stocks are maintained on a normal basis. The regular cell in barrel lots usually sells at $31 per 100 and the igniter at $32, though some cells can be secured at slightly reduced rates.

Linemen's Tools.—It is reported that it is difficult to get satisfactory deliveries of standard makes and that local stocks are very low.

Annunciator Wire.—Movement is very slow and stocks are inclined to be heavy. No. 18 on 1-lb. spools is quoted by one jobber at 43½ cents per lb., one cent is added for duplex and 2 cents for twisted pair.

Outlet Boxes.—A reduction of five points in the discount is reported this week. Representative prices are: 4-in. square box, 15 cents net; 4-in. round, 12½ cents; 3¼-in. round, 10 cents. Movement is inclined to be slow.

Meters.—Fairly good movement prevails in small lot orders. The type I-14, 5-amp., single-phase, is quoted at $9.42 and the type D-6, 25-amp., three-phase, at $40. Stocks may be slightly heavier than the demand warrants.

Lightning Arresters.—Reasonably good sales are being made to the smaller utilities and stocks seem to be in line. A standard type compression arrester is selling at $5.25 each.

Drills and Hammers.—There is very slow movement because of the lack of industrial activity. One jobber reports good interest in a new electric slate drill and an electric screw driver, but the devices have not been on the market long enough to develop sales in quantity.

Ammeters and Voltmeters.—Fairly good call is found for automobile instruments, but the demand for standard portables is practically dead. Switchboard instruments find some opening in plant enlargements of smaller utilities.

SEATTLE—PORTLAND

Outstanding features of the week's activities as reported by both retailers and jobbers in Seattle and the Puget Sound district are a further quieting down of trade, a slower pace in most all industries and continued slow collections. Jobbers' business is affected by depression along industrial lines, while retailers' business is poor because of refusal of the buying public to purchase appliances, etc. However, showing a revival that means prosperity for the state of Washington, foreign flour shipments from the state in June increased 263 per cent as compared with the May record, foreign fir lumber shipments jumped 167 per cent and wheat movement more than 100 per cent. These increases indicate a revival of buying power in foreign markets and a continuance, it is felt, will stimulate business and industrial activity to an enormous extent. Efforts of the commission to bring about a speedy settlement of the strike that closed virtually all of Washington's open-market coal mines nearly four months ago apparently have failed.

Northwestern jobbers in construction materials as a whole assert that there are prospects for a strong late summer and fall building season as there is considerable improvement in material markets and buying is considerably increased. In Seattle during June building permits were issued valued at $920,000 as compared to $1,324,000 during June of last year. Thus far this year there have been permits issued valued at $3,112,000 as compared with $7,909,000 last year for a like period. In Portland home building progressed at the average rate of $861,693 a month for the first six months of the year. This record is practically three times greater than for the corresponding period of last year. A total of 1904 permits have been issued for residences in Portland since the first of the year.

Farm Light Plants.—Because farmers are more or less reluctant about buying at a time when crop yields are uncertain, sale of plants are very few, although inquiries in considerable numbers are being received weekly by jobbers. Still sales efforts and educational programs are being carried on. Stocks of nearly all makes are excellent.

Schedule Materials.—Sales during the past two weeks have been off on account of the midsummer holiday but the letup is considered only temporary.

Fans.—Following a week of warm weather, fan sales of considerable proportions for Puget Sound have been noted. In Spokane and Eastern Washington cities fans have been moving exceptionally well for more than a month. Stocks are good and prices steady.

SAN FRANCISCO

Increasing sales of power companies' securities are reported and 1922 should see some active campaigns in new fields for the sale of the increased power that is now delivered, or almost ready to be delivered, in Northern and Central California. An electric range campaign will be actively under way during the latter part of this year. A committee of bridge experts has considered the terminals and construction of the mammoth bridge across the bay of San Francisco. The structural cost is estimated to be about fifty million dollars. Business interests of the bay cities are reported solidly behind the structure and propose to push energetically its construction.

The building trades strike enters its third month indecisively. More and more skilled workers are being brought from Eastern and Southern points, and even some of the big jobs now have workers of different classes upon them. So far the actual results are small. However, most of the electrical contractors now have a few men at work on the American plan and the situation seems to be working itself out in favor of a victory for the employers.

Fixtures.—Sales of fixtures in northern California are running about 20 per cent less in the country districts than normally and have dropped to a mere trickle in the bay cities because of the strike. Special sales campaigns have been tried for some of the nationally advertised fixtures to stimulate a demand. The southern California demand is excellent and is principally for simple bungalow types.

Heating Devices.—The new Edison and Hotpoint prices announced for July 15 were already in effect on July 1 and all dealers have marked their stocks accordingly. Retail prices on some standard makes of irons are widely divergent and there seems to be a price-cutting campaign on in some makes commonly quoted for $7 each in which they are being offered by competing department stores for as low as $4.50. Toaster and small grill sales are increasing, but hollow-ware sales, after the usual June stimulation, have slumped to a very low ebb.

SALT LAKE CITY—DENVER

Jobbers, in some cases excessively stocked, are taking the initiative in the matter of stimulating consumer demand. They are co-operating in every way possible with dealers in devising and putting over advertising and selling campaigns. Many unusual things are being resorted to to create sales, including actual cooking demonstrations in homes where cooking appliances are potentially in demand. Prospective customers are in the main continuing to sit tight in the belief that prices will materially recede in the not far distant future. Credit has not shown any recent change and collections are about as difficult as ever. There is little money available for expansion in the building field except in the case of homes. Thousands of smaller construction jobs are proceeding at a satisfactory rate, furnishing employment and an outlet for schedule material and lighting fixtures.

The latest crop forecast is highly encouraging. Bankers are showing a disposition to force farmers to liquidate by disposing of last year's crops at prevailing prices. This pressure, if generally applied, will remove a condition of economic stagnation that has helped demoralize business in the Intermountain country. A liberal appropriation for advertising the "electric home" idea was recently voted by the Rocky Mountain Electrical Co-operative League. Central stations are substantially interested in the project along with jobbers and contractor dealers.

Ranges.—The past week has recorded a $15 reduction in the type of three plate range that has been selling regularly at $145. The range demand has been fair during the weeks of June and July.

Electrical Appliances.—The recent 10 per cent reduction on appliances is said to have had a decidedly stimulating effect on sales and dealers are ordering from their jobbers at a more satisfactory rate.

Fans.—The fan season thus far has been disappointing, some sales are recorded on excessively hot days, but the general tone of the market is sluggish.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

"House Wiring Outlook Better," Says Boston Jobber

An encouraging improvement in the sale of wiring supplies is noted by Joseph E. Greene, of Joseph E. Greene, Inc., electrical supply jobber, of Boston, who informed a representative of the ELECTRICAL WORLD this week that house-wiring activities in eastern New England have for some months reflected a demand for electric service that is absorbing a goodly amount of material. This jobber notes a healthy demand for fixtures and portable lamps in connection with wiring improvements in the Northeastern territory. Industrial buying from New England jobbers is at present dull, he said, but considering general business conditions the movement of wiring supplies for residential service has been reasonably vigorous, especially since spring.

H. S. Whiting Doubling Last Year's Fixture Business

H. S. Whiting, president of the H. S. Whiting Company, Inc., New York City, manufacturer of the "Economy" and other commercial lighting units, states that business for the first six months of this year has surpassed the total recorded for the entire year 1920. The company has just recently moved its offices from 104 East Forty-first Street to Room 4839 Grand Central Terminal, and in line with the current volume of business has also increased its sales force. May was the biggest month recorded this year, it is stated, but June shows only a slight falling off. The company has only been in the lighting fixture business about a year and a half, having taken over the lighting fixture department of J. Livingston & Company, electrical contractors, New York City.

Luminous Unit Co. Matures Plans at Summer Conference

The Luminous Unit Company, St. Louis, Mo., held a sales conference at the home office June 27, 28 and 29, at which sales policies proper under present business conditions were discussed. According to Ray V. Owen, sales manager of the company, there was a rearrangement of discounts to jobbers and dealers and plans were matured to make it possible for jobbers to carry smaller stocks. Reports of representatives from various parts of the country indicated a great deal of business in prospect, much of it depending on the resumption of building. It was also disclosed that the greater part of present business is in special lighting units and that the demand for standard units is not holding up in proportion. Mr. Owen said the plant was working at about 40 per cent of normal and that he expected production to increase gradually during the fall.

Western Electric Opens Largest Electrical Warehouse

The new building of the Western Electric Company at 395 Hudson Street, New York City, which was officially opened on July 15, is not only said to be the largest concrete edifice on Manhattan Island but is also the largest combination warehouse, shop and office

CITY BLOCK COVERED BY JOBBING HOME

building occupied by any electrical supply jobber in the country.

The building occupies the entire block at Hudson and West Houston Streets, an area of 338 ft. x 200 ft., with a total floor space of 595,000 sq.ft. Several departments of the Western Electric have already moved into their new quarters, but the New York shops and the supply divisions of the Eastern district territory, which includes New York State, New Jersey, Pennsylvania and New England, and of the International Western Electric Company, will not take up their quarters there until everything is completed.

Although most of the building is eleven stories in height, there is a narrow five-story wing on Greenwich Street. Under this one roof will be housed the many departments which for several years have been scattered throughout the city. A special demonstration room is provided for showing latest developments in electrical household devices, farm-lighting equipment, etc. A conference room and restaurant are also provided. Special attention has been given to a conveyor system with automatic push-button control of deflectors for various floors, an overhead conveyor system for stacking conduit, and hoisting equipment and three monorail cranes which are capable of handling 6-ton loads each. Loading and receiving platforms can handle fourteen and twelve trucks respectively at the same time. Included in the power load of the building there are 117 motors in the shops averaging 1 hp. in capacity and ten averaging 23 hp. in capacity.

Increase in Territory and Product for E. G. Bartling

E. G. Bartling, manufacturers' agent, 703 Ford Building, Detroit, announces that Indiana has been added to his territory on all the lines he represents. In addition to the lines noted in the item giving his organization appearing in these columns on May 21, he is handling the product of the Magic Electric Company, New York City, and the Eagle Electric Manufacturing Company, Brooklyn, N. Y.

Hoover Sweeper Awarded Medal at English Health Exhibit

The Hoover Suction Sweeper Company, North Canton, Ohio, announces receipt of a medal emblematic of highest honors at the Royal Sanitary Institute's Health Exhibition in Birmingham, England. The award, it is said, was made in competition with every known make of electric sweeper or vacuum cleaner.

The Royal Sanitary Institute, founded in 1875, has for its purpose the education of the public to the practicability, hygienic and economic value of household utensils and equipment, and the Earl of Plymouth is the president. It is gratifying to note that an American manufacturer received this award.

In passing it might be remarked that no award was made in the line of washing machines.

The Permutit's Water Softening Patent Upheld

In a suit in equity by Permutit Company, 440 Fourth Avenue, New York City, against the Harvey Laundry Company, a user of the apparatus in question, and the Refinite Company, inventor and manufacturer thereof, to enjoin infringements of letters patent No. 1,195,923, Judge Hazel on June 15, in the United States District Court, Western District of New York, handed down a decision in favor of the Permutit Company.

The patent relates to an apparatus for softening water by using a mineral substance of relatively small grains of zeolites or hydrated alumino-silicates and their exchangeable bases. Judge Hazel in the last paragraph of his decision states: "As the claims in suit are found to be valid and to have been infringed by defendants, as contended by the plaintiff, an injunction and accounting is decreed with costs."

The Permutit Company advises that

it will supply complete particulars respecting this litigation to any companies that wish this information.

Medart Pulley Co. Launches New House Organ

The *Dart* is the name of the new house organ of the Medart Patent Pulley Company, St. Louis, Vol. 1, No. 1, of which appeared under date of June, 1921. No. 2 also is out for July. The *Dart* has been conceived to interest power users and men concerned with industrial affairs in the company's line-shafting equipment. The publication states that in 1879 Medart gave to American industry the first steel rim pulley ever built.

Stein & Ellbogen Take M. J. Silberberg Agency

The agency for time and motion study watches and other instruments of precision formerly held by M. J. Silberberg, has been taken over by the Stein & Ellbogen Company, 31 North State Street, Chicago, which will have exclusive control of their distribution. A new instrument of precision has recently come to the front said to combine the advantages of the stop watch and the time-study watch. It will be known as the "split-second time-study watch." For the convenience of its customers the company has established a five-day repair service.

June a Good Month for Electric Furnace Company

The Electric Furnace Company, Alliance, Ohio, reports more orders for its Baily electric furnaces in June than in any single month in the last two years. These orders include standard brass melting units, car furnaces for steel plant purposes, and a special electric enameling equipment. Most of the sales were made to concerns not particularly busy at the present time, but who purchased this equipment with a firm belief that by the time the furnaces were installed and ready for operation business would be such as to justify the present expenditure.

Indications point to an equally good month in July. The foundries are exhibiting a desire to modernize their equipment so as to lower their cost of production and meet competition when business again shall have become normal.

The Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, announces the opening of an office at 110 Hale Street, Charleston, W. Va., with Donald J. Baker as manager.

The Pawling & Harnischfeger Company, Milwaukee, has removed its San Francisco office from the Monadnock Building to 32 Beale Street. At the new location the company maintains a complete service station, warehouse and display rooms for electric cranes and hoists, machine tools and excavating machinery. R. M. Taylor, district manager for the Pacific Coast, has his headquarters at this office.

Harry G. MacLellan, James B. Fitch and Ernest A. Skinner, all of Angola, Ind., have organized what is to be known as the Electric Safety Equipment Company. The company will deal in all manner of electrical equipment.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile firm in Catania (No. 35,105) desires to purchase spark plugs, magnetos, storage batteries, etc.

An agency is desired by a merchant in Ireland (No. 35,128) for the sale of an iceless ice-cream freezer.

An advertising sign company in England (No. 35,146) desires to purchase electric motors of fractional horsepower (1/20 to 1/50 hp.), universal, voltage 100 to 250; complete with suitable reduction gears, etc.

A merchant in Scotland (No. 35,147) desires to secure an agency and to purchase electrical appliances, electrical household fittings, flashlights and batteries, etc.

A manufacturing firm in Chile (No. 35,142) desires to be placed in communication with manufacturers of electric furnaces for rolling mills. This furnace should be of an approximate capacity of 5 to 7 tons per day of twenty-four hours.

JAMAICA RAILWAY TO BE ELECTRIFIED.—A bill authorizing the Jamaican Government to take over the traction and light system of the city of Kingston, Jamaica, and to equip 127 miles of the National Railway for electrical operation is now being prepared by the Attorney-General for submission to the colonial office. The government proposes to borrow between $6,000,000 and $7,000,000 to carry out the project.

MUNICIPAL ELECTRIC PLANT FOR BARBERTON, SOUTH AFRICA. — Bids have been asked by the Municipal Council of Barberton, Transvaal, South Africa, for machinery and equipment for a municipal electric light plant and distribution system. Specifications call for two electric generating units driven by gas or steam engines.

PROPOSED ELECTRICAL WORK IN SOUTH MANCHURIA, CHINA.—According to the *Electrical Times*, the South Manchuria Railway Company contemplates an expenditure of 2,485,961 yen on electrical work during 1921-1922. The project includes the establishment of an electric experimental station at Darien the erection of a second power station at Darien, a third at Antung, and also extensions to the Darien electric tramway systems. There is also much other engineering work to be done.

ELECTRIC LAMPS FOR MONTEVIDEO, URUGUAY.—Local authorities in Montevideo, Uruguay, it is reported, are advertising for tenders to be submitted by Sept. 3 for furnishing 59,250 metallic filament lamps, from 10 to 300 cp., 225 volts, required by the State power house. Local representation is necessary.

LAMPS FOR ELECTRIC CAR LIGHTING IN AUSTRALIA.—The Victorian Government Railways Commissioners, Melbourne, Australia, are asking for tenders for furnishing 24,000 metal filament lamps (46 watts, 116 volts) for electric car lighting, 4,000 carbon filament lamps (32 watts, 140 volts), and a 5-hp. electric motor, controller, etc. Tenders for lamps to be submitted by July 27 and for motor, etc., Aug. 3.

SIGNALING APPARATUS FOR AUSTRALIAN RAILWAYS. — Tenders will be received by the Victorian Government Railways Commissioners, Melbourne, Australia, until Aug. 10 for 250 impedance bonds for power signaling (Contract 34,130) and 56 miles of insulated copper wire (Contract 34,131). Tenders will also be received until Aug. 17 for renewals for 3,000 sets of caustic soda primary cells (Contract 34,145). Specifications may be seen at the Department of Overseas Trade, 35 Old Queen Street, London, S. W. 1, England.

New Apparatus and Publications

COILED WIRE CARRIER.—The Baker R & L Company, Cleveland, has developed a device for its storage battery lifting trucks for handling and transporting wire in coils.

ELECTRIC ICE CREAM FREEZER.—A device for connecting a motor to an ice cream freezer is being marketed by Taylor Brothers Churn Company, St. Louis, with motor and freezer if desired.

OVERHEAD TROLLEY SYSTEMS.—The Whiting Corporation, Harvey, Ill., has developed its "short-turn overhead trolley system" for material handling employing short-radius curves, switches, cut-outs, etc.

SUCTION CLEANER. — The Pittsburgh Gage & Supply Company, P. O. Box 1236, Pittsburgh, Pa., has added a new "Gainaday" suction cleaner to its list of household appliances.

LIGHTING PLANT.—The Radiant Manufacturing Company, Sandusky, Ohio, manufacturer of light and power plants, has recently developed a 1½-kw. water-cooled, 32-volt generating unit, consisting of a gasoline engine, 3½ hp., directly connected to a General Electric generator through flexible coupling.

ELECTRIC DRILL.—An electric drill, known as the "One-Hand-Y Drill" has recently been placed on the market by the Knight Engineering & Sales Company, Los Angeles.

DIRECT-CURRENT MOTORS. — The General Electric Company, Schenectady, N. Y., is distributing bulletin No. 48,121.1A, entitled "Direct-Current Mill-Type Motors, Type MD and MDS," superseding bulletin No. 48,121.1.

GENERATORS. — The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing bulletin No. 1115, superseding bulletin No. 1098, entitled "Alternating-Current Generators," describing its engine-type generator units.

ELECTRIC SPECIALTIES.—The G & W Electric Specialty Company, 7440-52 South Chicago Avenue, Chicago, manufacturer of electrical specialties, has issued catalog 11, containing bulletin No. 211, covering its pot heads and accessories and bulletin 212, describing its underground boxes.

New Incorporations

THE INTERNATIONAL CORPORATION, Quinton, N. J., has been incorporated with a capital of $35,000 to develop electricity. The incroporators are G. Milton Harris, Quinton; Samuel W. Needy and Cornelius J. Benfer, Newark.

THE EVANS LIGHT & ICE COMPANY, Brooksville, Fla., has been incorporated with a capital of $25,000 to construct and operate electric light and power systems. The officers of the company are: W. D. Evans, president; Imo Evans, vice-president, and T. H. Evans, secretary and treasurer.

THE MIDLAND ELECTRIC COMPANY, Webster, S. D., has been incorporated with a capital of $25,000 by C. J. Strike, E. A. Sewall and W. W. Strike.

THE HOOSIER ELECTRIC LIGHT, HEAT & POWER COMPANY, Brewersville, Ind., has been incorporated with a capital of $20,000 by G. M. Robison, C. B. Stearns and E. A. Graves.

THE CROSS PLAINS (TEX.) POWER & LIGHT COMPANY has been incorporated with a capital of $25,000 by S. F. Bond, Taylor Bond and T. C. Cross.

THE NEON LAMP WORKS, New York, N. Y., has been incorporated with a capital of $9,000 to manufacture and deal in arc lamps. The incorporators and D. G. Albert, C. H. Carter and C. G. Katz.

THE GARDNER STORAGE BATTERY COMPANY, New Bedford, Mass., has been incorporated with a capital stock of $100,000 to manufacture storage batteries. The directors of the company are F. W. Gardner, president, Harold Gardner and Walter Gardner, 317 Rivet Street.

THE CAMBIA POWER COMPANY, Sanborn, N. Y., has been incorporated with a capital of $100,000 to generate electricity for light, heat and power. G. G. Mattern, Kenmore, is interested in the company.

THE BANGERT ELECTRIC COMPANY, Jamaica, N. Y., has been incorporated with a capital of $40,000 by W. A. and A. M. Bangert and T. Brieling.

Record of Electrical Patents

Notes on United States Patents

(Issued June 28, 1921)

1,382,620. WIRE CLAMP; William J. Carley, Culpeper, Va. App. filed Jan. 31, 1920. Trolley.

1,382,622. PROGRAM BATTERY-CHARGING DEVICE; James W. Bryce, Binghamton, N. Y. App. filed filed Oct. 29, 1918. For time clocks.

1,382,631. REPEATER CIRCUITS; Charles S. Demarest, Brooklyn, N. Y. App. filed May 17, 1919. One repeater employed for several circuits.

1,382,664. TROLLEY WHEEL; Otto Moore, Frankfort, Ind. App. filed March 26, 1910. Automatic sliding and rotating trolley.

1,382,738. AMPLIFYING APPARATUS; Marius C. A. Latour, Paris, France. App. filed June 8, 1918. Elimination of objectionable noises.

1,382,745. ELECTRICAL RECTIFIER AND POLE CHANGER; Fred Schoenwolf, Chicago, Ill. App. filed Feb. 16, 1917. Automatically rectifies alternating current.

1,382,766. PARTY-LINE LOCKOUT FOR TELEPHONE SYSTEMS; John W. Dorsey, Winnipeg, Manitoba, Canada. App. filed June 20, 1917. Lockout and signaling device.

1,382,781. ATTACHMENT FOR ELECTRIC IRONS; Adam Hausam, Richmond Heights, Mo. App. filed Aug. 11, 1920. Automatically opening plug.

1,382,786. ROTARY SPARK GAP; August J. Kloneck, New York, N. Y. App. filed June 3, 1916. High-tension current modified in frequency.

1,382,795. LIGHTNING ARRESTER; Ralph McNeill, Newark, N. J. App. filed May 4, 1920. Vacuum-tube.

1,382,808. PROCESS OF PRECIPITATING ALUMINUM COMPOUND; Mathias O. Sem, Christiania, Norway. App. filed April 23, 1918. Electrolysis.

1,382,817. MEANS FOR AUTOMATICALLY RECORDING CALLS IN TELEPHONE SYSTEMS; William J. Blair, Melbourne, Victoria, Australia. App. filed April 28, 1917.

1,382,873. STATIONARY INDUCTION APPARATUS; Edward A. Wagner, Fort Wayne, Ind. App. filed Sept. 23, 1919. Transformer clamps.

1,382,877. MEANS FOR FREQUENCY TRANSFORMERS; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 6, 1916. Frequency changer.

1,382,878. COOLING DYNAMO-ELECTRIC MACHINES; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Nov. 26, 1918. High-frequency alternator.

1,382,891. TELEPHONE SYSTEM; Bryant D. Campbell, Oakland, Cal. App. filed Feb. 6, 1917. Automatic means for counting coins.

1,382,899. TERMINAL FOR ELECTROLYTIC CONDENSERS; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Jan. 16, 1919. Will not corrode.

1,382,905. COOLING MEANS FOR ELECTRIC METAL-WORKING TRANSFORMERS; James H. Gravell, Elkins Park, Pa. App. filed Oct. 4, 1919. Welding transformer.

1,382,912. INSULATOR; Harry H. Hipwell, Pittsburgh, Pa. App. filed July 22, 1919. For a flashlamp.

1,382,914. AMPLIFYING SYSTEM; Charles A. Hoxie, Schenectady, N. Y. App. filed May 10, 1920. Electron discharge relays.

1,382,965. HIGH-TENSION RECTIFYING APPARATUS; Nicholas V. Fedotoff, Brooklyn, N. Y. App. filed March 22, 1918. Constant direct current obtained.

1,382,968. PROTECTIVE DEVICE; Henry G. French, Schenectady, N. Y. App. filed Oct. 24, 1919. Relay.

1,382,987. ARMATURE WINDING; Jan A. Kuyser, Edgewood, Pa. App. filed April 16, 1913. Means for interconnecting coils.

1,382,988. MOTOR-CONTROL SYSTEM; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed Nov. 3, 1917. Rolling mills.

1,383,011. SWITCH AND CONTACT MECHANISM FOR ELECTRIC-CURRENT-REGULATING PLUGS AND SOCKETS; Antonio Papini, Philadelphia, Pa. App. filed July 8, 1920.

1,383,033. ELECTRIC WATER HEATER; Louis E. Seimbille, Paris, France. App. filed Sept. 24, 1918. Heater combined with faucet.

1,383,034. ELECTRIC WATER HEATER; Louis E. Seimbille, Paris, France. App. filed Sept. 24, 1918. Considerable surface but small volume.

1,383,037. ELECTRIC CONTACT DEVICE; William E. Studstill, Murphy, N. C. App. filed July 13, 1920. Automatic train stops.

1,383,038. TELEPHONE CALL-WIRE CIRCUITS; John F. Toomey, New York, N. Y. App. filed June 10, 1919.

1,383,081. METHOD OF CONTROL FOR ELECTRIC MOTORS; Harry E. Dey, Jersey City, N. Y. App. filed Oct. 29, 1918. For electrically driven vehicles.

1,383,098. CONSECUTIVE OPERATION OF TWO OR MORE MECHANISMS; James F. Gill and John N. Chaviara, Liverpool, England. App. filed Feb. 26, 1919. Telegraphic.

1,383,108. ELECTRIC STEAM COOKER; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed July 26, 1917.

1,383,109. RANG; William S. Hadway, Jr., New Rochelle, N. Y. App. filed Aug. 1, 1917. Steam in conjunction with electric energy.

1,383,158. TROLLEY; Adam Shultz, Worcester, Mass. App. filed March 18, 1921. For preventing trolley from leaving wire.

1,383,186. WINDING APPARATUS; Carl A. Brink, Providence, R. I. App. filed July 13, 1918. For winding coils.

1,383,197. BED WARMER; John R. Fletcher, Dayton, Ohio. App. filed Jan. 16, 1920. Guard for incandescent lamp.

1,383,211. HEAT PRODUCING AND DISTRIBUTING ELEMENT; Charles E. Johnson and Andrew J. Jorgenson, Vancouver, B. C. App. filed April 28, 1920. Heats circulated air.

1,383,233. MEANS FOR DETECTING OR MEASURING MOISTURE; Charles A. Parsons and Alexander H. Law, Newcastle-Upon-Tyne, England. App. filed July 10, 1918.

1,383,236. THIRD-RAIL BRACKET-CLAMP CAP; Hugh Rice, Yonkers, N. Y. App. filed No. 10, 1920. For supporting and insulating third-rail.

(Issued July 5, 1921)

1,383,275. AMPLIFIER; Samuel E. Adair, New York, N. Y. App. filed Aug. 14, 1919. Tri-electric device.

1,383,303. COUPLING; James T. Honen, Cleveland, Ohio. App. filed March 20, 1919. For connecting circuits.

1,383,361. ENERGY-TRANSLATING DEVICE; William M. White, Milwaukee, Wis. App. filed Sept. 5, 1918. Ventilated brake for rotating parts.

1,383,472. AUTOMATIC TELEPHONE PAY STATION; George A. Long, Hartford, Conn. App. filed May 25, 1920.

1,383,487. OUTLET BOX; James J. Rutledge, Pittsburgh, Pa. App. filed April 10, 1919. Has knockouts.

1,383,494. REGULATOR; Edgar M. Soreng, Milwaukee, Wis. App. filed Aug. 25, 1916. Automatic battery charger.

1,383,534. AUTOMATIC TIME-INDICATING AND SIGNALING INSTRUMENT; Charles M. Crook, Chicago, Ill. Automatic control.

1,383,564. HEATING APPARATUS; Emil Phillipson, New York, N. Y. App. filed May 28, 1920. Combined fan and heater.

1,383,584. TELEPHONE SYSTEM; Ray S. Wilbur, Lyndhurst, N. J. App. filed Dec. 27, 1918. Arrangement for signaling.

1,383,588. SEMI-AUTOMATIC TELEPHONE EXCHANGE SYSTEM; Joseph L. Wright, Cleveland, Ohio. App. filed Oct. 29, 1915.

1,383,670. HEATING APPARATUS FOR USE IN OIL WELLS; James C. Stephens, Norfolk, Va. App. filed July 20, 1920.

1,383,677. TELEPHONE EXCHANGE SYSTEM; George Thompson, Mount Vernon, N. Y. App. filed Aug. 7, 1919. Circuit arrangement for line switches.

1,383,700. ACCOUSTIC DEVICE; Henry C. Egerton, Ridgewood, N. J. App. filed Aug. 14, 1918. Telephone transmitter.

1,383,718. ELECTRICAL CONNECTION; Albert C. Grunwald, Chicago, Ill. App. filed Aug. 8, 1919. For outlet box.

1,383,743. TELEPHONE EXCHANGE SYSTEM; Louis A. Mortimer, New York, N. Y. App. filed Aug. 24, 1918. Toll-line connections.

1,383,777. HEATING APPARATUS FOR USE IN OIL WELLS; James C. Stephens, Norfolk, Va. App. filed July 26, 1920. Electric.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CLIFTON, ME.—Investigations have been made by the Bangor Electric Company, Bangor, in Clifton with a view of installing an electric lighting system here.

SPRINGFIELD, MASS.—A petition has been presented to the City Council by merchants on Bank Street for the installation of additional electric lamps on that thoroughfare.

NEW BRITAIN, CONN.—The Connecticut Light & Power Company has petitioned the City Council for approval of the method of constructing a 13,000-volt transmission line between Black Rock and Church Street substations.

Middle Atlantic States

ALBANY, N. Y.—The Hires-Turner Glass Company, Thirtieth and Walnut Streets, Philadelphia, Pa., plans to build a one-story power house to be used in connection with its new plant on Tivoli Street, Albany. Estimated to cost about $100,000.

ATTICA, N. Y.—The Genesee Light & Power Company, Batavia, has applied to the Public Service Commission for permission to construct an addition to its electric plant at Attica for extensions in local service.

BINGHAMTON, N. Y.—Negotiations are under way for the extension of the Binghamton Light, Heat & Power Company's transmission system a distance of 27 miles north of Binghamton, covering the towns of Maine, East Union, Glen Aubrey, Whitney Point, Lisle, Killawog and Marathon. The plans provide for the construction of a new substation in the towns where energy will be distributed to the local power company in each village. The cost is estimated at about $70,000. R. L. Peterson is general manager.

DANSVILLE, N. Y.—Work is under way on the development of a hydro-electric plant on Bradner Creek about 2 miles from Dansville to supply power for the village creamery. The plans provide for three dams, the first, which is under construction, will be 28 ft. high, the second, 38 ft. high. Plans for the third dam are not completed. The three dams, it is estimated, will develop about 1,000 hp.

HERKIMER, N. Y.—The Herkimer Municipal Commission has been authorized by the Public Service Commission to build an addition to its municipal electric lighting system.

IONA ISLAND, N. Y.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 27, specification 4215, for improvements to the power plant at Iona Island. A deposit of $10 is required for plans. For information address the chief of bureau.

JAMAICA, N. Y.—The Ashland Contracting Company, 186 Remsen Street, Brooklyn, recently organized, contemplates the construction of an industrial project on Fulton Street, Jamaica. The plans provide for a central power house, central market building, ice and refrigerating plant and other mechanical buildings. The total cost is estimated at about $1,500,000. Michael H. Wolpert is president.

NEW YORK, N. Y.—The New York Edison Company, it is reported, will soon receive bids for the construction of a two-story substation, 40 ft. x 100 ft., at 224 East Fifty-second Street, to cost about $175,000.

SAG HARBOR, N. Y.—The Village Trustees have appointed a committee to investigate the feasibility of establishing a municipal electric and gas plant in Sag Harbor.

SPRINGVILLE, N. Y.—Bonds to the amount of $90,000 have been voted for the construction of a dam to supply power for the municipal electric light plant.

UTICA, N. Y.—Steps have been taken by merchants on Columbia Street in the downtown business section for the installation of ornamental lamps on that thoroughfare from Genesee Street to State Street.

DUSHORE, PA.—Application has been made by the Sullivan Electric Company to the Public Service Commission for charters for new electric companies to operate as subsidiary organizations at Laceyville, Forkston Township, Meshoppen Borough, Meheopany Township, Washington Township, Windham Township, Powell, Monroeton and vicinity. The application, it is understood, is preliminary to extensive development in these sections.

LEETSDALE, PA.—Tate-Jones & Company, Inc., manufacturers of industrial furnaces, oil heaters, etc., plan to install a centrally-located switchboard and carry its industrial load through one meter instead of two. James H. Knapp, 915 Empire Building, Pittsburgh, is general manager.

PHILADELPHIA, PA.—A recommendation submitted by James F. McLaughlin, chief of electrical bureau, appropriating the sum of $3,900,000 for the installation of a new fire alarm system has been approved by Director Cortelyou of the Department of Public Safety. It is proposed to apportion the appropriation as follows: New buildings and apparatus, $1,500,000; four substations, $100,000 each; equipment, $500,000; cables necessary to place police and fire wires underground, $1,500,000.

PHILADELPHIA, PA.—Plans have been filed by the Pennsylvania Sugar Company, 1037 North Delaware Avenue, for extensions and improvements in the power house at its works to cost about $15,000.

PHILADELPHIA, PA.—Bids will soon be received by the quartermaster, Frankford Arsenal, Philadelphia, for the installation of an electric lighting system in the experimental shop.

PITTSBURGH, PA.—Plans have been filed by the Northside Packing Company for the construction of a one-story power house on Romain Street, Northside.

TOWANDA, PA.—Application has been made by the Towanda Gas & Electric Company to the Public Service Commission for permission to organize two subsidiary companies to be known as the North Towanda Electric Company and the Wysox Electric Company.

WILKES-BARRE, PA.—Steps have been taken by the business men of Wyoming Avenue and Market Street to secure a new lighting system on those streets, replacing the arc lamps now in use with incandescent lamps mounted on standards.

CUMBERLAND, MD.—The City Council has authorized the installation of a new ornamental lighting system on Virginia Avenue.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until July 22, Brooklyn, Schedule 8456—10,000 ft. electric wire; Washington, Schedule 8462—miscellaneous quantity of wire, cable and lamp cord. Until Aug. 5, Mare Island, Schedule 8474—miscellaneous quantity of lamp cord and cable.

WASHINGTON, D. C.—Bids will be received at the office of A. L. Flint, general purchasing officer, Panama Canal, Washington, D. C., until August 1, circular 1453, for furnishing wire and cable, motors, pumps, insulators, voltmeters, switches, reflectors and receptacles.

North Central States

COLUMBUS, OHIO.—Bids will be received by the Board of Education of the City School District of Columbus, Ohio, Ohio National Bank Building, Columbus, until July 25 for electric wiring for the manual training motors at Avondale, Indianola and Roosevelt School buildings in said district. Plans and specifications are on file in the office of Howard Dwight Smith, school architect, 50 East Town Street, Columbus.

PIQUA, OHIO.—The Orr Felt & Blanket Company plans to build a new one-story power house for general mill service. Fretzinger & Sussellman, 1155 Reibold Building, Dayton, are architects.

TOLEDO, OHIO.—The Council has authorized the installation of 72 new lamps on Adams Street and 91 lamps in other parts of the city.

MOUNT STERLING, KY.—The Salt Lick Lumber Company plans to rebuild the power house at its mills, recently destroyed by fire.

KOKOMO, IND.—The Kokomo Steel & Wire Company is contemplating a number of additions and changes in its electrical system, including increasing the load from 400 kva. to 600 kva. and changing the system from 2,200 volts, two phase, 60 cycles, primary and 440 volts, three phase, three wire secondary to 4,000 volts, three phase, four wire, 60 cycles primary and 460 volts, three phase, 60 cycles, three wire secondary. J. E. Frederick is general manager.

BLOOMINGTON, ILL.—The city officials are considering the question of placing underground all wires in the city.

DUQUOIN, ILL.—The Southern Illinois Light & Power Company has been authorized by the Illinois Commerce Commission to erect and operate an electric transmission line from Duquoin to Mount Vernon and Waltonville.

OQUAWKA, ILL.—The Henderson County Public Service Company, Kirkwood, has applied for a franchise to furnish electricity in Oquawka.

PEKIN, ILL.—The Pekin Light, Heat & Power Company has applied to the Illinois Public Utilities Commission for permission to erect a transmission line from the Rockford power house in Pekin to South Pekin.

PEPIN, WIS.—The Wisconsin-Minnesota Light & Power Company is considering extending its line from Nelson to Pepin. An advance loan of from $15,000 to $17,000 would be required from the citizens of Pepin to cover half the cost of construction.

ST. PAUL, MINN.—Twenty buildings at Henry Schroeder's dairy farm on Rice Street, including power plant, farmhouse, barns, etc., were recently destroyed by fire causing a loss of about $100,000.

CORNING, IOWA.—Bonds to the amount of $60,000 have been voted for the construction of a municipal power plant in Corning.

DUBUQUE, IOWA.—A movement has been started by the Traveling Men's Greater Dubuque Club and the Kiwanis Club to secure extensions to the street lighting system in Dubuque.

WINTERSET, IOWA.—Bonds to the amount of $100,000 have been voted for the construction of a new municipal electric light plant.

RAYVILLE, MO.—The City Council has granted the Excelsior Springs Light, Heat & Power Company, a twenty-year franchise for the construction of an electric transmission line to Rayville for light and power purposes. A special election has been called by the Council to vote on a special lighting tax for street lamps.

BRUCE, S. D.—Bonds to the amount of $12,000 have been voted to install an electric lighting system. A 24-hr. service will be established.

Southern States

ATHENS, GA.—Arrangements have been made by the Athens Railway & Electric Company to issue $179,000 in bonds, the proceeds to be used for improvements, etc.

ATLANTA, GA.—Plans have been completed whereby the Morgan Falls plant of the Georgia Railway & Power Company will be changed from 25 cycles to 60 cycles. The plans provide for replacing the water wheels with larger units, rewinding the present 25-cycle alternators and substituting new rotarys for those now in use, changes in transformers, switchboards, etc.

JULIETTE, GA.—The Juliette Milling Company plans to build a hydro-electric generating plant on the Ocmulgee River to cost more than $150,000. Contract has been awarded to the Hardaway Construction Company, Atlanta, for the construction of the impounding dam.

ROCK MART, GA.—The City Council is considering the erection of a transmission line 2½ miles long, to connect with the system of the Georgia Railway & Power Company. The plans provide for the construction of a transformer station and the installation of an electric pump. The cost is estimated at $15,000.

ST. PETERSBURG, FLA.—The Grove Land & Timber Company, Asheville, N. C., has acquired 11,000 acres of land in St. Petersburg and proposes to develop it for live stock purposes. The plans provide for the construction of an electric light plant and waterworks. E. W. Grove is president.

FORT PAYNE, ALA.—A. A. Miller, Chattanooga, Tenn., has acquired the local municipal power plant which will be operated as a private enterprise to furnish local service. Extensive improvements including the installation of new equipment will be made.

VERBENA, ALA.—The Alabama Power Company, Birmingham, has been granted a preliminary permit for the construction of a dam, 74 ft. high and 1,600 ft. long, at Duncan's Riffle on the Coosa River near Verbena. The plans provide for an initial development of 60,000 hp. and an ultimate of 120,000 hp. The project is estimated to cost between $7,000,000 and $8,000,000.

ABBEVILLE, LA.—At an election to be held August 23 the proposal to issue $125,000 in bonds for the construction of an electric light and water plant will be submitted to the voters.

BATON ROUGE, LA.—The Baton Rouge Electric Company plans to extends its transmission lines to Dixie. The cost is estimated at about $200,000. T. L. Small is manager.

OKLAHOMA CITY, OKLA.—The plant of the Curtis-Bentley Woodworking Company, including a three-story structure and a power house, was recently destroyed by fire causing a loss of about $500,000 including machinery. The plant, it is understood, will be rebuilt.

EDGEWOOD, TEX.—A conference was recently held by H. Jalonick and M. P. Ross of Dallas, representatives of the Texas Power & Light Company, and a number of business men of Edgewood to discuss the probability of extending immediately the company's high-tension line from Terrell by way of Edgewood to Tyler. The cost of the line is estimated at about $300,000.

WHITNEY, TEX.—The City Council has authorized an election to be held July 25 to submit to the voters the proposal to issue $15,000 for rebuilding the electric light plant recently destroyed by fire. The town is at present without lighting service.

Pacific and Mountain States

BREMERTON, WASH.—The Council is considering the installation of an electric lighting system on Fifth Street.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has been authorized by the Railroad Commission to make considerable improvements and extensions.

Canada

GALETTA, ONT.—The Carleton County Council has authorized the erection of a transmission line by the Galetta Electric Power & Milling Company to supply energy to a number of farmers and for the Connaught rifle range. The line will extend from Galetta to Carp and from there to the township of March to the county road known as Carp No. 2, then along the March Road to the rifle ranges.

HAMILTON, ONT.—The Dominion Power & Transmission Company, Terminal Station, plans to construct a double-track electric street railway, 3,000 ft., on York Street from Queen to James Street, to cost about $100,000. E. P. Coleman is superintendent and engineer.

TORONTO, ONT.—The Board of Control has authorized the expenditure of $750,000 to enable the Toronto Hydro-Electric Power System to obtain equipment to be used in connection with supplying power for the Transportation Commission.

Miscellaneous

CITY OF MEXICO, MEXICO.—Plans are under way by the Mexican Light & Power Company for the construction of a 40,000-hp. hydro-electric plant to be used in connection with the Necaxa system, and to take care of present and future demands for additional power. The same water that passes through the present power plants, it is understood, will be used. The cost of the plant is estimated at $2,000,000.

PUEBLA, MEXICO.—S. Pearson & Son, Ltd., are considering additions and improvements to its hydro-electric plant near Orizaba and the street railway and lighting plants in Vera Cruz and Tampico. The transmission line which supplies light and power to Puebla from the Orizaba plant will be extended to other cities and industrial centers in this part of Mexico.